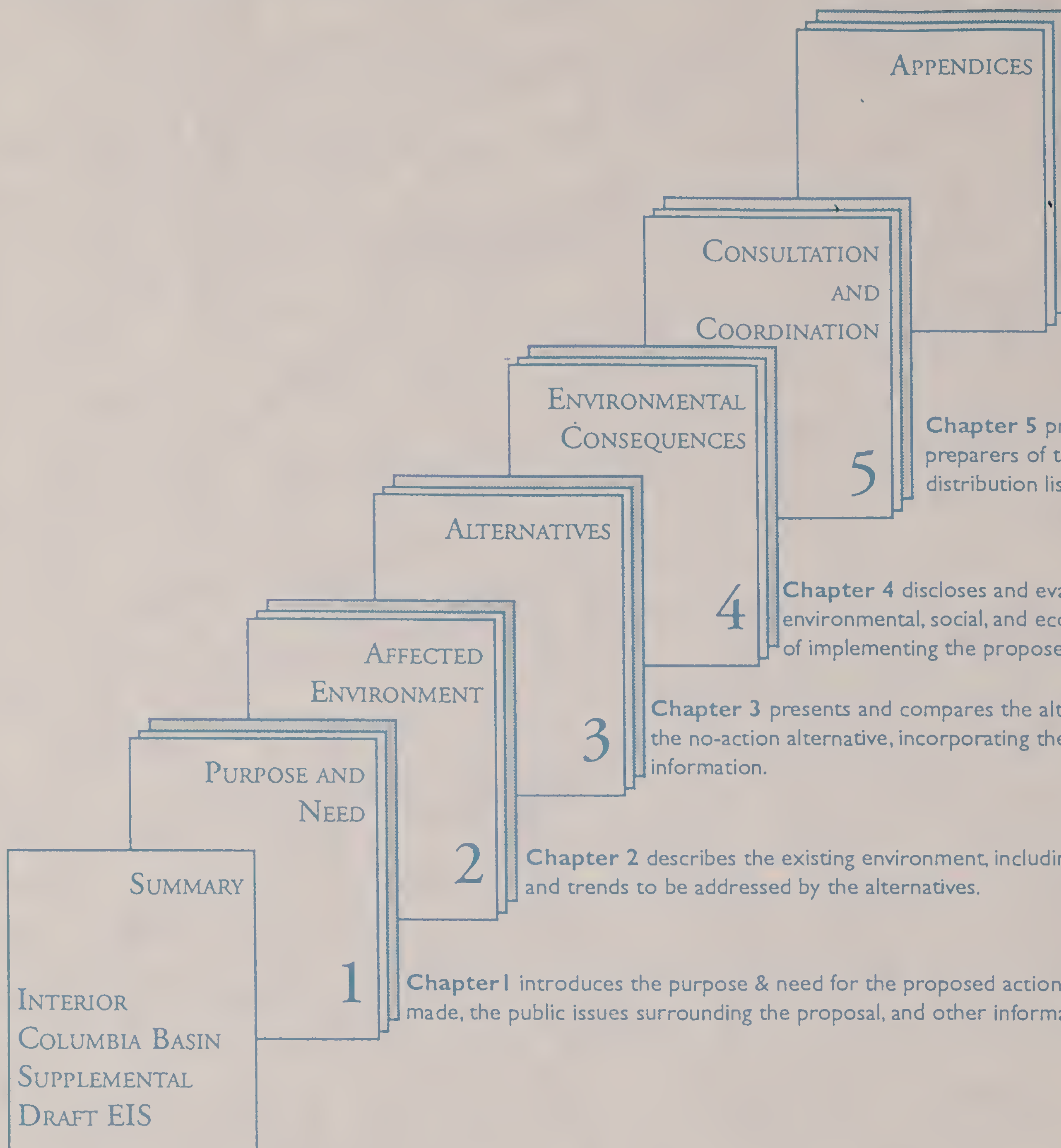
Department of Agriculture
Forest Service
United States Department of the Interior
Bureau of Land Management

Interior Columbia Basin Supplemental Draft Environmental Impact Statement

Volume 1

March 2000

Organization of This Document



Appendices provide additional documentation and details

Chapter 5 provides a list of preparers of the EIS, and a distribution list.

Chapter 4 discloses and evaluates the possible environmental, social, and economic consequences of implementing the proposed alterantives.

Chapter 3 presents and compares the alternatives, including the no-action alternative, incorporating the latest scientific information.

Chapter 2 describes the existing environment, including conditions and trends to be addressed by the alternatives.

Chapter I introduces the purpose & need for the proposed action, the decisions to be made, the public issues surrounding the proposal, and other information.

BLM/OR/WA/Pt-00/019+1792

INTERIOR COLUMBIA BASIN ECOSYSTEM MANAGEMENT PROJECT

Interior Columbia Basin Ecosystem Management Project

P.O. Box 2344
Walla Walla, WA 99362
(509)522-4030 Fax:(509)522-4025
TTY:(509)522-4029

304 N. 8th Street,
Room 250
Boise, ID 83702
(208)334-1770 Fax:(208)334-1769

Dear Reader:

Thank you for your interest in the management of public lands in the interior Columbia River Basin. A more coordinated, ecosystem approach to managing Bureau of Land Management- and Forest Service-administered lands is needed. This Supplemental Draft Environmental Impact Statement (EIS) outlines three management alternatives for your review. Of the three alternatives presented, Alternative S2 has been identified as the preferred alternative.

This Supplemental Draft EIS supplements the Eastside and Upper Columbia River Basin Draft EISs released in June 1997, and is written to be a stand-alone document. The accompanying issues, alternatives, and analyses were significantly influenced by the more than 83,000 comments received on the Draft EISs. The responses to the public comments on the Draft EISs are found in Appendix 4, *Response to Comments*.

We look forward to receiving your comments on this draft document. Your opinions, insights and suggestions are critical to shaping a successful management strategy. Your written comments will be most helpful if they are specific, mention particular pages or chapters where appropriate and address one or more of the following issues:

- How well the preferred alternative meets the purpose and need statements,
- Which other alternative or parts of alternatives you would support or prefer, and why,
- Items that need clarification, and
- New information that could have a bearing on the analysis.

You will have 90 days to review this draft document. After full consideration of all comments received, a Final EIS and Record of Decision will be issued. The Record of Decision will amend 62 individual land use plans on the 32 Forest Service and Bureau of Land Management administrative units in the project area. The selected alternative will also replace the interim management strategies of PACFISH, INFISH, and the Eastside Screens.

We are accepting written comments through the mail at SDEIS; P.O. Box 420; Boise, ID 83701-0420 or electronically by accessing the project's web site at http://www.icbemp.gov/eis. (A copy of the Supplemental Draft EIS and the unattached appendices are also posted at this web site.)

We appreciate your interest and participation in crafting a management strategy for Forest Service- and Bureau of Land Management-administered lands in the interior Columbia River Basin.

Sincerely,

Susan Giannettino

SUSAN GIANNETTINO
Project Manager

Geoff Middaugh

GEOFF MIDDAUGH
Deputy Project Manager

Interior Columbia Basin Ecosystem Management Project

Interior Columbia Basin Supplemental Draft Environmental Impact Statement

Volume 1

Lead Agencies

USDA Forest Service, Intermountain, Pacific Northwest, and Northern Regions
USDI Bureau of Land Management, Idaho, Montana, Oregon, and Washington

Responsible Officials

Dale Bosworth, Regional Forester, Forest Service Northern Region
Jack Blackwell, Regional Forester, Forest Service Intermountain Region
Harv Forsgren, Regional Forester, Forest Service Pacific Northwest Region
Martha Hahn, Idaho State Director, BLM
Larry Hamilton, Montana State Director, BLM
Elaine Zielinski, Oregon/Washington State Director, BLM

For further information contact

Susan Giannettino, Project Manager
304 N. Eighth Street, Room 250
Boise, ID 83702
Telephone 208/334-1770; Fax 208/334-1769

Geoff Middaugh, Deputy Project Manager
P.O. Box 2344
Walla Walla, WA 99362
Telephone 509/522-4033; Fax509/522-4025

Abstract

The U. S. Department of Agriculture, Forest Service, and the U. S. Department of the Interior, Bureau of Land Management (BLM), propose to develop and implement a coordinated, scientifically sound, broad-scale, ecosystem-based management strategy for lands they administer across parts of Idaho, Oregon, Montana, and Washington (approximately 63 million acres). The Interior Columbia Basin Ecosystem Management Project (ICBEMP) Supplemental Draft Environmental Impact Statement (EIS) supplements the Eastside and Upper Columbia River Basin (UCRB) Draft EISs released in June 1997. The Supplemental Draft EIS presents three management alternatives. *Alternative S1*, the no-action alternative, would continue current management on individual units of Forest Service- and BLM-administered lands under existing approved plans, as amended or modified by direction known as PACFISH, INFISH, and Eastside Screens, and by applicable Biological Opinions. *Alternatives S2 and S3* focus on restoring and maintaining ecosystems across the project area and providing for the social and economic needs of people, while reducing short- and long-term risks to natural resources from human and natural disturbances. Under Alternative S2, an emphasis on conducting analyses (such as Subbasin Review and Ecosystem Analysis at the Watershed Scale) prior to conducting management activities is intended to minimize short-term risk from management activities in areas where short-term risks are of most concern, and to ensure actions occur in the most appropriate locations in the most appropriate sequence. Under Alternative S3, some short-term risk is acceptable, and less emphasis is placed on conducting Subbasin Review and Ecosystem Analysis at the Watershed Scale prior to conducting management activities. More areas are identified under Alternative S3 as high priority for restoration compared to Alternative S2.

The *preferred alternative* identified by the Regional Executive Steering Committee is Alternative S2 (which replaces Alternative 4 of the Draft EISs as the preferred alternative), because the regional executives feel it responds best of all 10 alternatives (from the Draft EISs and the Supplemental Draft EIS) to the purpose and need statements and the five goals under a refined project focus. The analysis of effects of the alternatives indicates that Alternative S2 would provide the strongest and best strategy for: restoring the health of the forests, rangelands, and aquatic–riparian ecosystems in the project area; recovering plant and animal (including fish) species; avoiding future species listings; and providing a predictable level of goods and services from the lands administered by the BLM and the Forest Service. In general, Alternative S2 also would best address tribal rights and interests. Mitigation of adverse effects has been incorporated into the preferred alternative. Monitoring, determined to be an important part of adaptive management, is outlined in the Implementation Framework.

Comments on the Supplemental Draft EIS should be received no later than 90 days after the notice of availability of the EIS is published in the *Federal Register.* Comments should be sent to:

SDEIS
P. O. Box 420
Boise, ID 83701-0420

or electronically access the Project web page:
http://www.icbemp.gov/eis

ICBEMP Supplemental Draft EIS

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Humans and Land Management: Snapshots in Time

Humans have been a part of the project area's ecosystems for many centuries. The story of how the environment has influenced people and how people have influenced the environment provides a valuable context for this EIS—including the purpose and need (Chapter 1), current conditions and trends (Chapter 2), and the alternatives described and analyzed in Chapters 3 and 4. It has taken decades for the condition of the environment to be what it is today, and it may take decades to change conditions to what people desire them to be. This section provides brief snapshots of this history (derived from Quigley and Arbelbide 1997).

First Settlement (pre-1800s)

Survival dictated movements and activities of the project area's first human inhabitants more than 12,000 years ago. These first people adapted culturally and socially to major climatic, environmental, and resource distribution changes, forming attachments to places they visited seasonally. Archeological evidence indicates that they were hunting nomads who followed big game herds (including mammoths, mastodons, musk oxen, and *bison antiquus*), and maintained settlements in riverine, lake, and wetland environments. As the climate moderated over the past 4,000 years, their settlement, land use, and seasonal migration strategies and patterns apparently shifted to more diversified systems with a greater use of upland and mountainous environments. These migratory settlement patterns allowed landscapes to recover during periods of non-use.

Natural resources were, and still are, an integral part of all aspects of the culture of Native Americans. Hundreds of plant and animal species, landscapes, minerals, and natural processes (such as weather) developed cultural significance through subsistence, religion, traditional stories, commerce, social values, and other mechanisms.

Native Americans actively participated in and interacted with ecosystems in many ways. They routinely started fires to aid their hunting and encourage growth of certain culturally significant plants. These fires differed from lightning-caused fires in terms of season, frequency, and intensity (Lewis 1985). The widespread use of fires by American Indians over long periods helped shape the mosaic of vegetation and its associated animal communities in the interior West. Tribes kept large herds of horses, which were introduced in the 1700s and early 1800s by Euroamericans. These non-native species grazed large portions of the project area. The intensity and frequency of these grazing patterns differed from those of native big game species.

Pioneer Settlement (1800s)

The abundant harvestable resources of the Columbia Basin were a principal attraction for early Euroamerican settlers. The earliest Euroamerican contact with native cultures in the project area occurred during the Lewis and Clark Expedition in 1804 to 1805; soon thereafter, the region opened up to further exploration, fur trade, military posts, missionary work, and settlement. The United States government encouraged western settlement. Private citizens, railroad companies, and timber and mining interests were granted free land in exchange for meeting various development requirements. The evolution of transportation played a major role in commercial development of the area.

Survival was the non-native settlers' driving force; however, their survival tactics had little in common with those of native people. Many Euroamerican settlers also had little concept of limits, particularly where natural resources were concerned—they saw the West as a vast area with a limitless supply of raw materials.

From 1840 to 1860, most overland migrants passed through the Columbia Basin and continued on to the Willamette Valley's open meadows and proximity to navigable waters. This began to change with the discovery of gold in the basin, which encouraged more people to migrate into the interior Oregon Country, the heart of what is now called the interior Columbia River Basin. The development of "local" economies resulting from

Agriculture, in addition to mining and timber, supported the region's economy near the close of the 19th century.

mining led to the formation of new territories. Transportation systems (wagon roads, steamboats, and later railroads) were rapidly developed to link the mines to trade centers and to the outside world.

Growing populations in California cities created a market for food and timber that could be produced in the Pacific Northwest and shipped along the coast. Commercial salmon fishing and cattle and sheep ranching became more profitable because of the new access to markets made possible by the railroads. Land grants given to the railroads further spurred development, with establishment of communities as transportation centers and with substantial forest lands being turned over to private ownership.

Following mining and agriculture, a third leg of the region's economy, the timber industry, took off near the close of the 19th century. Serving only local markets at first, the timber industry paralleled the development of mines and railroads; railroads needed wood for ties and trestles, mines needed timbers for shoring, and lumber mills needed access to the woods to extract logs. Throughout the period from the mid 1800s to the early 1900s, a dominant philosophy in the Congress was to dispose of public lands and to minimally manage those lands remaining in the public domain (Clawson 1962).

As the land became settled and developed, the natural environment began to change. For example, waterways were altered when beaver dams washed away after beavers were trapped out of the area. Further changes occurred when settlers built dams for irrigation and later to generate power, altering fish habitats. Settlers trapped predators, such as wolves, cougars, and coyotes, that were preying on their livestock. As a result, predators' traditional prey, such as elk, deer, and antelope, experienced rapid population growth. Overgrazing by both wild and domestic animals altered vegetation.

Euroamericans changed native people's cultures as well. Effects included: disease; population decimation and displacement; accommodations to new trade systems and goods; new cultural and religious beliefs and and practices; and competition for lands, traditional places, and resources. This period of direct competition and conflict between native and Euroamerican people culminated in a treaty-making period that ended in 1871. Treaties between Indian tribes and the U. S. government gave tribes exclusive title to reservation lands. Some treaties also established trust responsibilities for the federal government, in which the government promised access to lands for traditional uses, such as hunting, fishing, gathering, and livestock grazing.

In the early 1900s, tribal negotiations with state and federal agencies met with mixed results concerning treaty reserved rights to subsistence activities. American Indians' way of life and use of the land and its resources were altered, but traditional lifeways persisted even as Indians increasingly conformed to non-Indian lifestyles. During economically depressed periods, renewed reliance on traditional foods and other practices helped sustain many tribal economies.

Euroamerican settlers also began to view the land differently. By the 1900s, resource extraction was a major part of the West's economic base. After discovery of valuable mineral deposits throughout the West, the Mining Law of 1872 set direction for mining activity on public lands. Establishment of the Reclamation Service in 1902 led to construction of a vast network of dams, canals, and ditches that hastened settlement of the arid lands of the project area.

Recognizing Limits (early to mid 1900s)

As resources were used and land was settled, people began to realize that natural resource supplies were limited and that a public land management strategy was needed to ensure future supplies. The Congress responded by creating federal land management agencies responsible for managing public lands for sustainable natural resource production. The Forest Reserve (the Forest Service's predecessor) was formed in 1891. The Bureau of Land Management's predecessor, the Grazing Service, was established in 1934. In 1916, the National Park Service was created to administer the growing set of national parks and monuments. The agencies began to set and enforce land use limits.

The early Forest Service was guided by the Organic Act (1897) which stated that "dead, matured, or large growth of trees" could be designated and sold for the appraised value. The act further specified that harvest would preserve living and growing timber, and promote younger growth. The agency's mission was also defined by a multiple-purpose policy adopted in 1905: "Provide the greatest good for the greatest number in the long run."

Similarly, the Taylor Grazing Act (1937) gave specific direction to the Bureau of Land Management. By leasing public lands to stockraisers, the act sought to "stop injury to the public grazing lands ... by preventing overgrazing and soil deterioration; to provide for their orderly use, improvement, and development; [and] to stabilize the livestock industry dependent upon the public range." After nearly a century of policies to dispose of public lands and to minimally manage public lands, the federal government began to view the remaining public domain as a storehouse to sustain productive values.

Commodity Production (mid 1900s)

Public priorities shifted as the United States went through two world wars and the Great Depression. The depression brought the Civilian Conservation Corps, a federal program whose participants built much of the infrastructure still found on public lands, including hundreds of Forest Service roads, stock watering projects, ranger stations, campgrounds, and telephone systems. When public demand for natural resources increased exponentially, the agencies were able to meet expectations.

New Deal programs were critical in sustaining and building infrastructure in the interior Columbia Basin, especially the dam projects along the Columbia and Snake rivers. There was a broad public consensus to construct the dams, even though biologists recognized at the time that dams would be barriers to native salmon runs, a significant number of which spawn in streams on BLM- or Forest Service-administered lands (Peterson 1995).

The wars brought both economic prosperity and a heightened demand for resources such as timber, livestock, and minerals. Three factors caused the federal land management mission to change: the post-war housing boom; the prediction that there would be a rising, long-term demand for timber; and private timber shortages. In 1944 the administration decided that forested federal lands would become active timber sources rather than timber reserves. Timber production skyrocketed. From 1945 to 1970, timber harvest on federal lands in the project area increased about 5 percent per year, or 50 percent faster than the growth of the national economy.

Environmental Awareness (late 1900s)

The 1960s brought increasingly complex and conflicting demands on public land management within the project area. Wilderness enthusiasts and others sought to put recreation on an equal footing with extractive uses. Traditional commodity users—loggers, ranchers, and miners—argued for greater allocation to their particular needs. Members of a growing environmental movement wanted land management decisions to be based on interdisciplinary scientific information. The public wanted to be actively involved in land management decisions.

In recent years the Forest Service and BLM have experienced a transition in management emphasis, resulting from additional scientific knowledge, increased public environmental awareness, new legislation enacted by the Congress, and challenges in court. The Forest Service and the BLM are still required to supply resources for public use and allow access to commodity resources. Both agencies are also required to protect and improve natural resources.

Recent and long-standing legislation pertaining to natural resources and federal land management enacted by the Congress has created a complex collection of regulations that often result in conflicting management applications. Early legislation concerning federal land management activities primarily emphasized production and use of resources (General Accounting Office Report on Ecosystem Management, August 1994). The Congress enacted legislation creating incentives to provide specific levels of certain natural resource commodities and other uses from public land administered by the Forest Service or the BLM. Both agencies are required to share receipts from the sale or use of natural resources with the states or counties within which the activities occur. For many years congressionally appropriated funds have been linked to managing and harvesting timber, minerals, and livestock forage, as the Congress specified "target" levels of timber sales, along with the production of other goods and services from these lands.

More recently, increasing scientific and public concern about declining conditions of natural resources led the Congress to enact laws to protect specific natural resources. These laws include amendments to the 1948 Clean Water Act, major amendments to the 1955 Clean Air Act, and the enactment of the Endangered Species Act (1973). The Congress encouraged research on national forests by enacting the Forest and Rangeland Renewable Resources Planning Act of 1978, and the Cooperative Forestry Assistance Act of 1978.

Recognizing that activities on federal lands relate to protection of natural resources, the Congress also enacted a series of procedural laws requiring federal agencies to identify and disclose the potential effects of their activities. Primary among these laws is the National Environmental Policy Act (NEPA) (1969), which requires federal agencies to identify and consider the direct, indirect, and cumulative effects of activities on federal land, both alone and in conjunction with the activities of other agencies and landowners. The Forest and Rangeland Renewable Resources Planning Act (1974), the National Forest Management Act (1976), and the Federal Land Policy and Management Act (1976) all contain requirements for the Forest Service and/or BLM to develop long-term land management plans.

These laws continue to be interpreted through federal courts, sometimes requiring adjustments in how the Forest Service and BLM plan for and administer these lands.

Chapter 1

Purpose and Need

Contents

Key Terms Used in Chapter 1

Adaptive management —A process which involves planning, implementing, monitoring, evaluating, and incorporating new knowledge into management approaches. It builds on current knowledge, observation, experimentation, and learning from experience, which is then used to modify management methods and policies. Adaptive management is further discussed in Chapter 3 and Appendix 10.

Administrative unit —A management area, such as a Forest Service national forest or ranger district; or a Bureau of Land Management (BLM) district, field office or resource area, under the administration of one line officer. Forest Service line officers are district rangers and forest supervisors; BLM line officers are district managers, field office managers, and area managers.

Biological diversity (biodiversity) —The variety and variability among living organisms and the ecological complexes in which they occur.

Eastside Screens — Interim management direction establishing riparian, ecosystem, and wildlife standards for timber sales on Forest Service-administered lands in eastern Oregon and Washington.

Ecological integrity — In general, refers to the degree to which all ecological components and their interactions are represented and functioning; the quality of being complete; a sense of wholeness. Areas of high integrity would represent areas where ecological function and processes are better represented and functioning than areas rated as low integrity.

Ecological processes —The flow and cycling of energy, materials, and organisms in an ecosystem.

Ecosystem-based management —The use of an ecological approach to achieve multiple-use management of public lands by blending the needs of people and environmental values in such a way that Forest Service- and BLM-managed lands represent diverse, healthy, productive, and sustainable ecosystems.

Ecosystem health (forest health, rangeland health, aquatic system health) —A condition where the parts and functions of an ecosystem are sustained over time and where the system's capacity for self-repair is maintained, such that goals for uses, values, and services of the ecosystem are met.

INFISH — Interim Inland Native Fish Strategy for the Intermountain, Northern, and Pacific Northwest regions (Forest Service).

Issue (planning) —A matter of controversy, dispute, or general concern over resource management activities or land uses. To be considered a "significant" Environmental Impact Statement (EIS) issue, it must be well defined, relevant to the proposed action, and within the ability of the agency to address through alternative management strategies.

PACFISH — Interim strategy for managing Pacific anadromous fish-producing watersheds in eastern Oregon and Washington, Idaho, and portions of California.

Project area — In this EIS, refers to the Interior Columbia Basin Ecosystem Management Project (ICBEMP) area affected by decisions in the Record of Decision. It encompasses both the "Eastside" and "Upper Columbia River Basin" ("UCRB") planning areas as described in the Draft EISs, minus the areas excluded from the decision space (see the Project Area section in this chapter).

Resilience — (1) The ability of a system to respond to disturbances. Resiliency is one of the properties that enable the system to persist in many different states or successional stages. (2) In human communities, refers to the ability of a community to respond to externally induced changes such as larger economic forces.

Restoration — Holistic, system-wide actions to modify an ecosystem to achieve a desired, healthy, and functioning conditions and processes. Generally refers to the process of enabling an ecosystem to resume acting, or continue to act, following disturbances as if disturbances were absent. Restoration actions can be either active or more passive.

Scoping —The early stages of preparation of an environmental impact statement, used to solicit public opinion, receive comments and suggestions, and determine the issues to be considered in the EIS analysis.

Sustainability — (1) Meeting the needs of the present without compromising the abilities of future generations to meet their needs; emphasizing and maintaining the underlying ecological processes that ensure long-term productivity of goods, services, and values without impairing productivity of the land. (2) In commodity production, refers to the yield of a natural resource that can be produced continually at a given intensity of management.

Viable population —A population that is regarded as having the estimated numbers and distribution of reproductive individuals to ensure that its continued existence is well distributed in the project area.

For additional terms, see the Glossary

Introduction

The Interior Columbia Basin Ecosystem Management Project (ICBEMP) Supplemental Draft Environmental Impact Statement (EIS) presents three alternatives for managing lands administered by the U.S. Department of Agriculture, Forest Service or the U.S. Department of Interior, Bureau of Land Management (BLM) across parts of Idaho, Oregon, Montana, and Washington. A no-action alternative continues 62 individual land use plans currently in effect on 32 Forest Service or BLM administrative units (national forests or BLM districts/field offices) in the project area. Two action alternatives propose variations of a coordinated, scientifically sound, ecosystem-based management strategy focusing on issues that are broad-scale in nature and interrelated. The selected strategy would amend the 62 land use plans.

This Supplemental Draft EIS supplements the Eastside and Upper Columbia River Basin Draft EISs released in June 1997. It was written as a stand-alone document to the extent possible; however, some maps, appendices, and other information from the Draft EISs are sometimes referred to without reprinting them in this document. A Final EIS and subsequent Record of Decision (ROD) will provide a context for managers to make sound local decisions while considering effects, particularly cumulative effects, at a scale larger than individual administrative units. The selected alternative also will replace several interim management strategies with consistent long-term direction.

This chapter provides background and describes the proposed action, project area, purpose of and need for the action, decisions to be made, and the public involvement process, including planning issues. Chapter 2 characterizes the existing condition of the project area, including trends based on historical and current conditions. Alternative management strategies for agency-administered lands in the project area are developed and described in Chapter 3, incorporating the latest scientific information. The possible environmental, social, and economic consequences of implementing each alternative are evaluated and displayed in Chapter 4. Chapter 5 provides information on the preparers of this document, and a list of tribes, agencies, organizations, businesses, and groups who either contacted or were contacted by the project staff. The Glossary, Literature Cited, and Index can be found at the end of the document. Appendices, in Volume 2, provide additional documentation and details.

Background

In the western portion of the Pacific Northwest, a long-lasting controversy has surrounded management of old forests and associated species on federal lands. This controversy resulted in a series of lawsuits, court rulings, appeals, and protests. The Northwest Forest Plan (USDA Forest Service and USDI BLM 1994) was completed to address those issues.

The traditional approach of individual BLM and Forest Service offices addressing single resource issues has sometimes resulted in conflicting management direction among agencies and offices.

In recent years, a similar controversy developed in the interior portion of the Pacific Northwest concerning management of old forests, forest health, anadromous fish species, riparian areas, and other issues on federal lands. The traditional approach of individual BLM and Forest Service offices addressing single resource issues has sometimes resulted in conflicting management direction among agencies and offices, as well as management of competing resource needs. Interim strategies (PACFISH, Eastside Screens, and Inland Native Fish Strategy), described later in this chapter, were put in place to preserve management options while long-term strategies were developed.

In July 1993, President Clinton directed the Forest Service to "develop a scientifically sound and ecosystem-based strategy for management of eastside forests." The President's direction was part of his plan for ecosystem-based management in the Pacific Northwest. The strategy initially covered National Forest System lands east of the crest of the Cascade Range in Oregon and Washington. The BLM joined this effort later in 1993, and an interagency EIS Team was formed to begin work on the Eastside Draft EIS. In July 1994 the BLM Director and Forest Service Chief added another EIS Team to jointly develop an ecosystem-based management strategy for lands administered by the Forest Service or BLM in the upper Columbia River Basin. That strategy was presented in the Upper Columbia River Basin Draft EIS.

To provide the appropriate context for development and implementation of these management strategies, the Chief of the Forest Service and Director of the

BLM chartered an interagency team of federal scientists in early 1994. This team, referred to as the Science Integration Team, was directed to: study ecological, economic, and social systems; examine current and historical conditions; and evaluate whether outcomes from current practices and trends would be consistent with long-term maintenance of ecological integrity and ecosystem health.

The Science Team was chartered to develop the following documents:

- A *Framework for Ecosystem Management in the Interior Columbia Basin including Portions of the Klamath and Great Basins,* (Haynes, Graham, and Quigley 1996) provides broad concepts and processes recommended for ecosystem analysis, planning, management, and monitoring at various scales. The ICBEMP EIS processes are consistent with principles in the Framework.
- *An Integrated Scientific Assessment for Ecosystem Management in the Interior Columbia Basin including portions of the Klamath and Great Basins* (in this EIS, referred to as *Integrated Assessment*; Quigley, Haynes, and Graham 1996), and *Assessment of Ecosystem Components in the Interior Columbia Basin and Portions of the Klamath and Great Basins* (in this EIS, referred to as *Assessment of Ecosystem Components*; Quigley and Arbelbide 1997). Together the two assessment documents constitute the *Scientific Assessment*. The *Scientific Assessment* examines historical and current ecological, social, and economic systems on all lands, regardless of ownership. Information generated in the *Scientific Assessment* was used as the basis for developing the ICBEMP EIS.
- *Evaluation of EIS Alternatives by the Science Integration Team.* The *Evaluation* (Quigley, Lee, and Arbelbide 1997) analyzes the effects and practicality of implementing each alternative management strategy as described in Chapter 3 of the Draft EISs. The *Evaluation* provided an estimate of likely outcomes and cumulative effects from the alternatives across the entire project area and was used to develop the effects analysis described in Chapter 4 of the Draft EIS.

These science documents, which were used in the development of the ICBEMP EIS, are described in more detail in Appendix 1.

Upon completion of these documents, the Science Integration Team was disbanded and a smaller core of scientists, many from the original team, was formed. This group was called the Science Advisory Group (SAG). This group was assigned to: assist with transfer of data and science findings to the administrative units; prepare scientific publications; complete analysis in support of the Supplemental Draft EIS, Final EIS, and Record of Decision; assist with developing methods to facilitate implementation; and provide integrated research efforts.

The SAG developed the *Science Advisory Group Effects Analysis for the SDEIS Alternatives*. This Supplemental Draft EIS effects analysis, like the Draft EIS evaluation, analyzed the effects and practicality of implementing each alternative, provided an estimate of the likely outcomes and cumulative effects from the alternatives, and was used to develop the effects analysis described in Chapter 4.

As directed by the project charter, as amended, ICBEMP strategies:

- Focus on restoring the health of forest, range, aquatic, and riparian ecosystems;
- Draw from the *Scientific Assessment* and other science team products as well as other forest health studies (Everett et al. 1994, Sampson and Adams 1994, and others);
- Are scientifically sound and ecosystem-based;
- Recognize the integration of human elements with biophysical systems;
- Involve the public in an open, multi-agency process; and
- Are analyzed through an environmental impact statement.

The two Draft EISs were released for public review in June 1997. During an 11-month comment period, nearly 83,000 comment letters were received from individuals, agencies (including the U.S. Environmental Protection Agency, National Marine Fisheries Service, and U.S. Fish and Wildlife Service), tribes, and organizations. A comprehensive analysis of public comment was published in October 1998 (Content Analysis Enterprise Team, *Final Analysis of Public Comment for the Eastside and Upper Columbia River Basin Draft Environmental Impact Statements*).

During the comment period, the ICBEMP Executive Steering Committee decided to combine the Eastside and Upper Columbia River Basin EISs into one EIS for the entire project area. They made this decision to emphasize that one broad-scale strategy is being developed; to simplify further public, agency, and science review; and to save time and money in preparation, printing, and distribution of additional documents.

Based on public, agency, and science input on the Draft EISs; new information from science; and discussions with tribal and interagency partners, a refinement to the design of the overall strategy for the project was initiated. This refined focus was emphasized in a letter from the Secretaries of Interior and Agriculture (October 8, 1998) to those members of the Congress who represent constituents of the states located in the project area. The Babbitt/Glickman letter stressed a new approach for ICBEMP management direction that would address a limited number of issues which must be resolved at the basin level, while allowing flexibility for other issues to be dealt with at finer scale or local levels. This new approach was directed to be presented in a supplemental draft EIS.

Proposed Action

The Forest Service and BLM propose to develop and implement a coordinated, scientifically sound, broad-scale, ecosystem-based management strategy for lands they administer in the ICBEMP project area.

Project Area

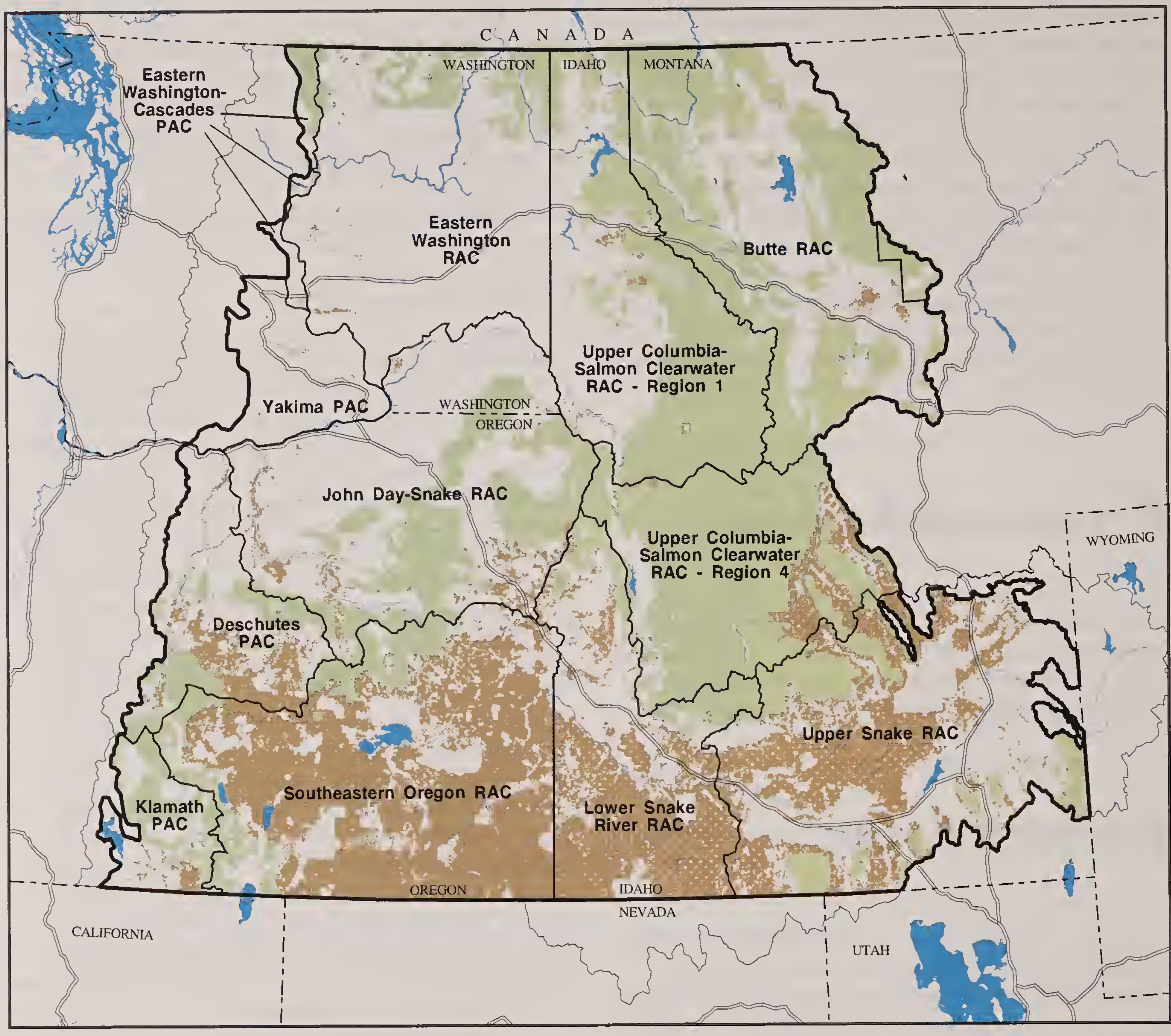
The ICBEMP project area includes land administered by the BLM or Forest Service in the portions of the interior Columbia River Basin, upper Klamath Basin, and northern Great Basin that lie east of the range of the northern spotted owl (east of the Northwest Forest Plan boundary) in Oregon and Washington, and the parts of Idaho and western Montana that are drained by the Columbia and Snake rivers, with the exceptions noted below. The EIS covers approximately 63 million acres of agency-administered lands. Map 1-1 illustrates the ICBEMP project area, indicating the Forest Service- and BLM-administered lands to which the management direction in Chapter 3 applies. It also shows Resource Advisory Council (RAC) and Provincial Advisory Committee (PAC) boundaries. It is intended that some of the implementation and coordination will be conducted by RAC or PAC area. Table 1-1 lists the national forests and BLM districts that lie wholly or partially within the project area. RAC/PAC areas are described and listed in the Introduction for Chapter 2.

Exceptions

The ***Targhee and Bridger-Teton national forests and portions of the Caribou National Forest*** that lie within the boundaries of both the ICBEMP project area and the Greater Yellowstone Ecosystem are excluded from decisions resulting from this EIS (*Federal Register* [FR] Notice 60 FR 40153). This exception was made in order to avoid implementing direction for the national forests of the Greater Yellowstone Ecosystem on a piecemeal basis. (Hughes and Bosworth 1995).

The ICBEMP project area as described in the Draft EISs included those portions of ***Wyoming, Nevada, and Utah*** that were drained by the Snake River and its tributaries (see Map 1-2). The refined management direction, as described above, limits the issues to be addressed with the ICBEMP direction to those that must be resolved at the basin level. Issues requiring a basin-wide approach were not identified on the BLM-administered lands within the Columbia River Basin in Wyoming. In Utah, the Forest Service will replace its interim INFISH strategy (which applies to native fish within the planning area) through the Sawtooth National Forest Plan revision, scheduled for completion by the end of the year 2000. In Nevada, the Forest Service will replace the interim INFISH strategy through a plan amendment process. Therefore, no federally administered lands within Wyoming, Utah, or Nevada (totalling 6.6 million acres) will be included in the Supplemental Draft EIS, Final EIS, or Record of Decision (ROD) for the Interior Columbia Basin Ecosystem Management Project. The vast amount of scientific information generated by the ICBEMP scientists is available for use during the plan revision or amendment processes.

The project area as described in the Draft EISs also included ***areas of overlap with the Northwest Forest Plan*** in eastern Oregon and Washington, as delineated in the *Record of Decision for Amendments to Forest Service and BLM Planning Documents Within the Range of Northern Spotted Owl*, 1994 (see Map 1-2). This area (4.6 million acres of Forest Service- and BLM-administered lands) was removed from the ICBEMP Supplemental Draft EIS to reduce confusion over how Northwest Forest Plan decisions would be affected by ICBEMP decisions. Therefore, the ICBEMP ROD will not apply to areas managed under the Northwest Forest Plan, although those areas, as well as the agency-administered lands in Wyoming, Utah, and Nevada, were considered when determining cumulative effects of the decisions in the ICBEMP ROD.



50 0 50 100 150 miles

50 0 50 100 150 km

N

Map 1-1.
BLM- and Forest Service-Administered Lands

INTERIOR COLUMBIA
BASIN ECOSYSTEM
MANAGEMENT PROJECT

Supplemental Draft EIS Area
2000

- Forest Service-Administered Lands
- BLM-Administered Lands
- Water
- Major Rivers
- Major Roads
- RAC/PAC Borders
- Supplemental Draft EIS Area Border

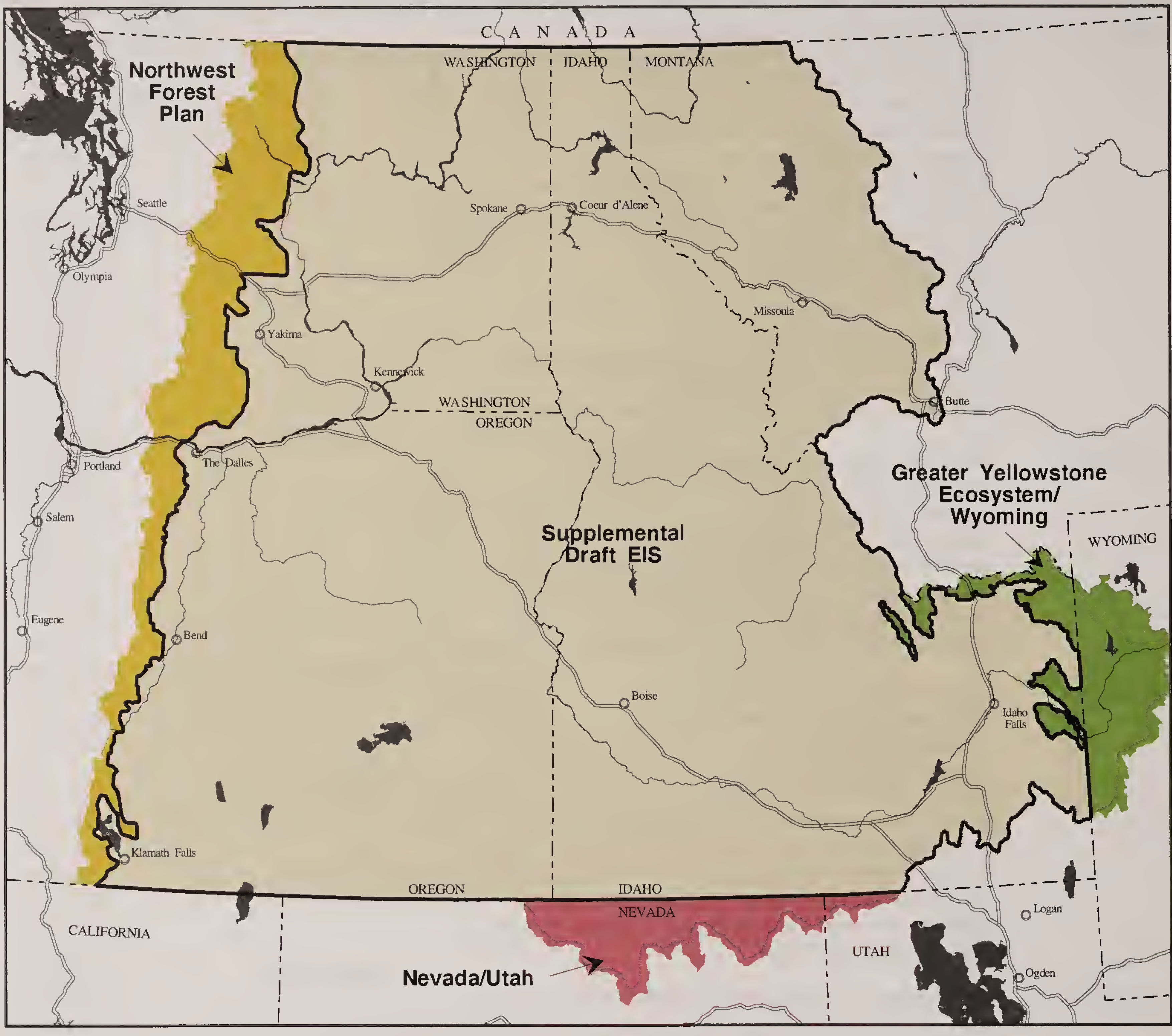
Table 1-1. National Forests and BLM Districts Affected by the ICBEMP EIS.

State	National Forest or BLM District		Acres Affected[1]
Idaho	Bitterroot National Forest (Idaho Portion)		468,500
	Boise National Forest		2,573,500
	Caribou National Forest[2] (Idaho portion)		574,000
	Clearwater National Forest		1,815,000
	Idaho Panhandle National Forest (Idaho Portion)		2,336,000
	Kootenai National Forest (Idaho Portion)		45,000
	Lower Snake River BLM District		6,210,500
	Nez Perce National Forest		2,111,500
	Payette National Forest		2,354,000
	Salmon - Challis National Forest		4,150,500
	Sawtooth National Forest		1,691,000
	Upper Columbia - Salmon Clearwater BLM Districts		1,550,500
	Upper Snake River BLM Districts		3,975,000
	Wallowa-Whitman National Forest (Idaho Portion)		131,500
		Idaho Total	**29,986,500**
Montana	Bitterroot National Forest (Montana Portion)		1,115,000
	Deerlodge National Forest		695,000
	Flathead National Forest		2,369,500
	Helena National Forest		384,500
	Idaho Panhandle National Forest (Montana Portion)		27,500
	Kootenai National Forest (Montana Portion)		2,206,500
	Lolo National Forest		2,075,000
	Missoula BLM Field Office (formerly Butte BLM District)		148,500
		Montana Total	**9,021,500**
Oregon	Burns BLM District		3,417,000
	Deschutes National Forest[3]		835,500
	Fremont National Forest		1,140,000
	Lakeview BLM District		3,347,500
	Malheur National Forest		1,459,500
	Ochoco National Forest[4]		964,000
	Prineville BLM District		1,645,500
	Umatilla National Forest		1,068,500
	Vale BLM District (Oregon Portion)		5,043,000
	Wallowa-Whitman National Forest[5] (Oregon Portion)		2,249,000
	Winema National Forest		733,000
		Oregon Total	**21,902,500**
Washington	Colville National Forest (Washington Portion)		1,087,000
	Idaho Panhandle National Forest (Washington Portion)		119,000
	Okanogan National Forest		696,500
	Spokane BLM District		336,500
	Umatilla National Forest		311,000
	Vale BLM District (Washington Portion)		10,500
		Washington Total	**2,560,500**
		ICBEMP EIS Total	**63,471,000**

Abbreviations used in this table:
BLM - Bureau of Land Management
EIS - environmental impact statement
GIS - Geographic Information System

1 ICBEMP acres listed are only those administered by the BLM or the Forest Service
2 Curlew National Grassland acres included
3 Newberry Crater National Volcanic Monument acres included
4 Crooked River National Grassland included
5 Hells Canyon National Recreation Area acres included

Source: ICBEMP GIS data (converted 100 x 100 meter grid and rounded to the nearest 500 acres). These totals will not match official government land office (GLO) totals or those shown elsewhere in document that were calculated from a 1000 x 1000 meter grid (1 km^2).



Map 1-2.
Areas Excluded from
ICBEMP Decision Space

INTERIOR COLUMBIA
BASIN ECOSYSTEM
MANAGEMENT PROJECT

Supplemental Draft EIS Area
2000

Supplemental Draft EIS Area
Northwest Forest Plan Area
Nevada/Utah Area
Greater Yellowstone Ecosystem/Wyoming Area
Water
Major Rivers
Major Roads
Supplemental Draft EIS Area Border
Cities and Towns

Implications for Multiple Administrative Units

The process for making programmatic decisions is described in both Forest Service regulations (36 CFR 219) and BLM regulations (43 CFR 1600). Those processes were designed in the 1970s to facilitate planning for individual administrative units, and to address issues specific to those units. In contrast, the ICBEMP EIS and resulting decision will focus on broad-scale issues that cross jurisdictional boundaries. This focus will provide a broad context for management strategies that cannot adequately be developed at the individual BLM and Forest Service land use plan level. The purpose and need for the proposed action is much broader than a traditional Forest Service or BLM land use plan/EIS, and is based on a different management approach—ecosystem-based management.

Much of the management direction in this EIS is applicable to multiple administrative units in aggregate rather than to individual units. As such, it is not the intent to predict actions, effects, or outputs for each unit. Moreover, determinations with respect to each administrative unit that would normally be made as part of the planning process are not possible. Therefore, those types of determinations will continue to be made for each administrative unit during subsequent land use plan amendment and revision processes.

The purpose and need is much broader than a traditional Forest Service or BLM land use plan/EIS, and is based on a different management approach—ecosystem-based management.

Purpose of and Need for Action

The intent of the Purpose and Need Statement has not changed from what was presented in the Draft EISs. A few editorial changes have been made to add clarity and respond to public comments.

Major Changes from Draft EISs

Project Area Exclusions

Originally, the Draft EISs covered approximately 75 million acres of land administered by the BLM or the Forest Service. With the following exclusions, the Supplemental Draft EIS covers approximately 63 million acres of agency-administered land.

Northwest Forest Plan: The Eastside Draft EIS included areas of overlap with the Northwest Forest Plan in eastern Oregon and Washington. These areas will no longer be covered by the ICBEMP Record of Decision. As a result, the following administrative units are excluded from the ICBEMP decision:

Washington	Gifford Pinchot National Forest Wenatchee National Forest Columbia River Gorge National Scenic Area (NSA)	*Oregon*	Columbia River Gorge NSA Medford BLM District Mt. Hood National Forest

Nevada, Utah, Wyoming: The UCRB Draft EIS included areas administered by the BLM or Forest Service in Nevada, Utah, Wyoming. These areas will no longer be covered by the ICBEMP Record of Decision. As a result, the following administrative units are excluded from the ICBEMP decision:

Nevada	Humboldt National Forest Elko BLM Field Office Winnemucca BLM Field Office	*Utah*	Sawtooth National Forest, Utah portion Salt Lake BLM Field Office
Wyoming	Rock Springs BLM Field Office		

Purpose

The purpose of the proposed action is to take a coordinated broad-scale approach and to select a management strategy that best achieves a combination of the following:

- Restore and maintain long-term ecosystem health and ecological integrity.
- Support economic and/or social needs of people, cultures, and communities, and provide sustainable and predictable levels of products and services from lands administered by the Forest Service or the BLM, including fish, wildlife, and native plant communities.
- Update or amend, if necessary, current Forest Service and BLM management plans with long-term direction, primarily at regional and subregional levels.
- Provide consistent direction at regional and subregional levels to assist federal managers in making decisions at a local level within the context of broader ecological considerations.
- Emphasize adaptive management over the long term.
- Help restore and maintain habitats of plant and animal species, especially those of threatened, endangered, and candidate species, and of special interest to tribes. This would be done primarily by moving toward desired ranges of landscape conditions at a regional and subregional ecosystem basis.
- Provide opportunities for cultural, recreational, and aesthetic experiences.
- Provide long-term, broad-scale management direction that will replace interim strategies (PACFISH, Eastside Screens, and Inland Native Fish Strategy).
- Identify where current policy, regulation, law, or organizational structure may act as challenges to implementing the strategy or achieving desired future conditions.

Need

Changed conditions over the past century and new information and understandings indicate that the ecosystems of the interior Columbia River Basin are declining in health. Ecosystems must be healthy, diverse, and productive to meet the needs of society today as well as those of future generations. Restoring and maintaining ecosystem health and ecological integrity will better support the economic and/or social needs of people, cultures, and communities. The twin needs are compatible with and dependent on each other.

Therefore, the alternative management strategies examined in detail in this EIS are based upon underlying needs for:

- **Restoration and maintenance of long-term ecosystem health and ecological integrity on Forest Service- and BLM-administered lands.** There is a need to restore and maintain forest, rangeland, aquatic, and riparian ecosystem health and integrity. There is also a need to identify desired conditions of vegetation structure, composition, and distribution; hydrologic processes and functions; and aquatic habitat structure and complexity.
- **Support of the economic and/or social needs of people, cultures, and communities, through availability of sustainable and predictable levels of products and services from Forest Service- and BLM-administered lands.** There is

One of the purposes of the project is to support the social and economic needs of communities in the project area.

a need to contribute to the vitality and resiliency of human communities. There is also a need to provide for people's uses and values of natural resources consistent with maintaining healthy, diverse ecosystems.

Identification of these needs comes primarily from three considerations which have developed or become more apparent since current land management plans were signed:

- Changed conditions;
- New information and understandings of ecological relationships; and
- Requirements and authority for more comprehensive, regional, and subregional long-term management direction.

Changed Conditions

The *Scientific Assessment* (*Integrated Assessment*, Quigley, Haynes, and Graham 1996, and *Assessment of Ecosystem Components*, Quigley and Arbelbide 1997) provides information characterizing historical and current conditions, as well as associated trends. The *Scientific Assessment* and other project publications (including *Source Habitats for Terrestrial Vertebrates of Focus on the Interior Columbia Basin: Broad-scale Trends and Management Implications* [Wisdom et al. in press] and *Economic and Social Characteristics of Communities in the Interior Columbia Basin* [ICBEMP 1998]) document accelerated changes in vegetation patterns, fish and wildlife distributions, terrestrial and aquatic ecosystem processes, and human communities that have occurred in the project area in the past century.

Changed conditions and new information and understandings indicate that the health of some of the interior Columbia River Basin ecosystems are declining. People - including those individuals who live and work in resource-dependent communities, as well as other public lands stakeholders - value and need healthy ecosystems and their associated plants and animals for social, cultural, ecological, economic, and other reasons.

These conditions have evolved over many decades as a result of the interaction of human activities and naturally occurring events.

Today's society values some of the changes that have occurred on federal lands since historical times, while other changes may cause concern. Many pre-settlement conditions are neither reasonable nor possible to recreate because of factors as diverse as population growth, urban development, dams, highways, and land use and ownership patterns. Historical conditions are not a goal; they are needed for reference to help understand landscape potential, how landscapes evolve, the role of disturbance on the landscape, and human influences on landscapes.

Some specific changes are considered to be symptoms of declining ecological integrity and ecosystem health. Healthy forests, rangelands, and aquatic and riparian areas and their associated fish, wildlife, and plant species, are valued and needed by the public—including those members of the public

Ecosystem Health

A healthy ecosystem is one that has the capacity to sustain itself over time and to react as expected or desired. Healthy ecosystems are able to convert sunlight into plant and animal tissue, sustain life and its many processes, and provide products and places for people. If an ecosystem is healthy, it will continue to support diverse, viable plant and animal populations, clean air and water, and fertile soils. To do this, the parts and functions of the ecosystem need to work well together.

One measure of health is an ecosystem's ability to recover from disturbances, such as fires, insects, or floods. Another word for this is *resiliency*, which is the ability to self-repair after disturbance and the ability to adapt to change. Healthy ecosystems can recover from disturbances without losing their processes or functions, although recovery may take varying amounts of time.

Trend:	Concern:
In forestlands, increasing susceptibility to uncharacteristic levels of insects and disease, and to wildfires of uncharacteristic intensity.	Poses significant threats to ecological integrity, water quality, species recovery, and homes in rural areas.
In rangelands, loss of native grasslands and shrublands. In rangelands and forestland, spread of noxious weeds and exotic plants.	Displaces native plant species, lowers biological diversity, degrades soil, and poses other ecological risks that jeopardize uses and public expectations including livestock grazing, timber production, wildlife habitat, scenery, and recreation. Reduces system's ability to buffer against undesired change.
In rangelands, forestlands, aquatic and riparian ecosystems, declines in habitat for some threatened or endangered species and other native plants and animals, including fish.	Leads to loss of animals and plants of interest to American Indian tribes and others for hunting, fishing, cultural, recreational, social, educational, ecological, and other purposes.
Loss of soil productivity.	Threatens biological productivity, water flow and runoff, site stability, ecosystem resiliency; fewer trees and forage plants can be grown, risks of landslides increase, soil organism cannot recycle nutrients.
Altered watersheds, including loss of hydrologic and riparian area function.	Poses increased risk of landslides, declines in water quality, flooding, loss of riparian-dependent plant and animal species.
In some rural resource-dependent communities, decline in amount and predictability of commodity flows from public lands.	Contributes economic and social uncertainty regarding industry investments, jobs, income, local school funding. Leads to lack of public confidence in the sustainability of environmental values and production of commodities.

who live and work in nearby resource-dependent communities as well as other stakeholders of public lands—for social, cultural, ecological, economic, and other reasons. The types of changes that indicate declining ecosystem health and a subsequent need for management response are listed here and are described in more detail in Chapter 2 of this EIS and in the *Scientific Assessment*.

New Information and Understandings

Considerable research, studies, and reports documenting some of these changed conditions were published recently. These studies reveal both new information and a better understanding of the implications of these changes for long-term ecosystem health. For example, cumulative human activities and management practices—such as timber harvest, fire exclusion, pest suppression, livestock use, road construction, mining and waste disposal, flood control and irrigation, agricultural development, fish harvest and hatcheries, increased recreation use, and urban expansion—are now known to have affected natural resource conditions in ways that were previously not fully understood. This new information and understanding must be addressed. The Council on Environmental Quality's (CEQ) regulations for implementing the National Environmental Policy Act (NEPA), along with supporting guidance from the Forest Service and BLM, require that agencies re-examine existing management direction in light of significant new circumstances or information relevant to environmental concerns and bearing on existing management or its impacts.

The following is a partial list of the major studies documenting these changed conditions. Some of these are discussed in more detail in Appendix 1. For a complete list of literature cited in this EIS, see the Literature Cited section following Chapter 5. Studies published before 1995 were listed in the Draft EISs; most are not re-listed here (with the exception of PACFISH). Additional studies published since the release of the Draft EISs have been added to the list.

- *Source Habitats for Terrestrial Vertebrates of Focus on the Interior Columbia Basin: Broad-scale Trends and Management Implications* (Wisdom et al. in press);
- *Economic and Social Characteristics of Communities in the Interior Columbia Basin* (ICBEMP 1998);
- *An Assessment of Ecosystem Components in the Interior Columbia Basin and Portions of the Klamath and Great Basins.* (Quigley and Arbelbide 1997);
- *An Integrated Scientific Assessment for Ecosystem Management in the Interior Columbia Basin and Portions of the Klamath and Great Basins.* (Quigley, Haynes, and Graham 1996);
- *Return to the River: Restoration of Salmonid Fishes in the Columbia River Ecosystem.* (Northwest Power Planning Council 1996);
- *Upstream: Salmon and Society in the Pacific Northwest.* (National Research Council 1996);
- *PATH - Plan for Analyzing and Testing Hypotheses - Conclusions of FY96 Retrospective Analyses.* (Marmorek and Peters 1996; Marmorek, Peters, and Parnell 1998);
- *Inland Native Fish Strategy Environmental Assessment Decision Notice and Finding of No Significant Impact: Interim Strategies for Managing Fish-producing Watersheds in Eastern Oregon and Washington, Idaho, Western Montana, and Portions of Nevada* (INFISH) (USDA Forest Service 1995);
- *Wy-Kan-Ush-Mi-Wa-Kush-Wit: The spirit of the salmon.* (Columbia River Intertribal Fish Commission 1995); and
- *Environmental Assessment for the Implementation of Interim Strategies for Managing Anadromous Fish-producing Watersheds in Eastern Oregon and Washington, Idaho, and Portions of California (PACFISH)* (USDA Forest Service and USDI Bureau of Land Management 1994).

Requirements or Authority for New Long-term Management Direction

Requirements or authority for permanent ecosystem-based management direction have come from: directives; commitments made through interim direction; and court orders including *Pacific Rivers Council vs. Thomas* (see Appendix 1-5 in the Eastside Draft EIS or Appendix B in the UCRB Draft EIS for more details).

Directives

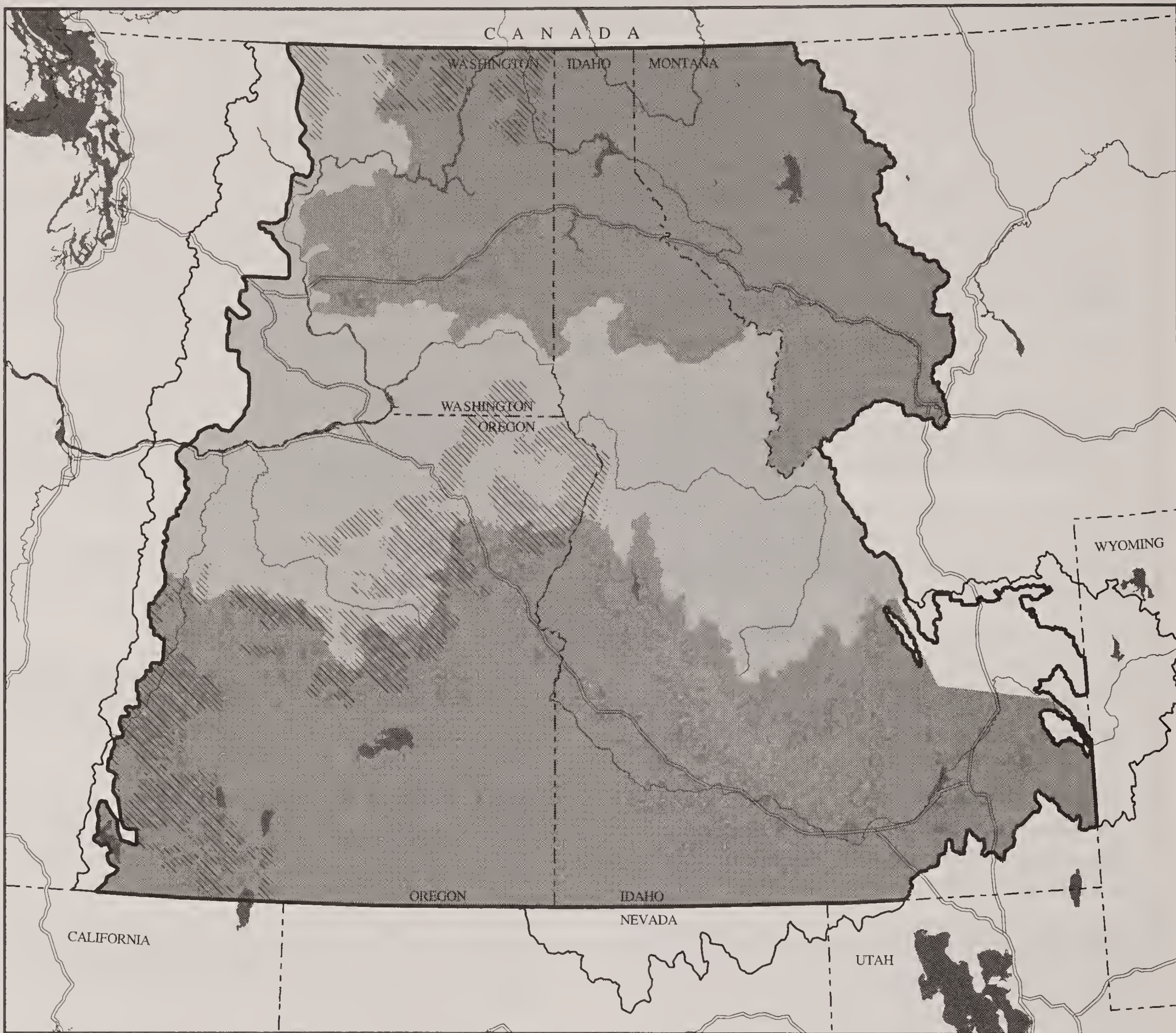
The following illustrates agency-level directives applicable to ecosystem-based management:

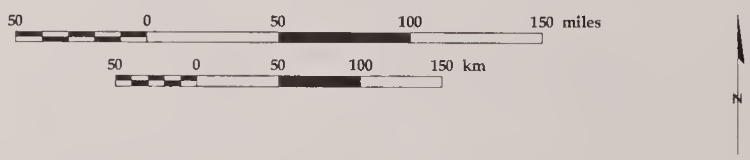
- Secretaries of the Interior and Agriculture October 1998 letter to the Honorable George R. Nethercutt Jr., U.S. House of Representatives on the subject of the ICBEMP approach and supplemental environmental impact statement.
- Chief of the Forest Service's March 1998 Natural Resource Agenda for Sustainable Forest Ecosystem Management.
- Chief of the Forest Service's October 1994 Forest Service Ethics and Course to the Future.
- Chief of the Forest Service's 1994 decision related to the Forest Service's Western Forest Health Initiative.
- BLM's late 1993 directive to develop a scientifically sound and ecosystem-based strategy with the Forest Service for eastside BLM-administered lands, which led to directives in the project charter.
- Director of the BLM's August 20, 1993 memo and January 1994 Information Bulletin (IB-94-191), directing BLM employees to undertake an ecosystem-based approach to land management.
- President Clinton's July 1993 directive, mandating the Forest Service to develop a scientifically sound and ecosystem-based strategy for management of eastside forests.
- Chief of the Forest Service's June 4, 1992 directive, mandating regional foresters and research station directors to undertake ecosystem-based management on national forests and grasslands.

Commitments Made Through Interim Direction

Three separate interim management strategies apply to much of the project area (see Map 1-3). Decisions made as a result of the Interior Columbia Basin Ecosystem Management Project will replace that direction. Those strategies and their commitments for the project are:

- **PACFISH.** *Implementation of Interim Strategies for Managing Anadromous Fish-Producing Watersheds in Eastern Oregon and Washington, Idaho, and portions of California* (February 24, 1995): Calls for a long-





**Map 1-3.
Interim
Management Strategies**

Inland Native Fish Strategy*
PACFISH
Eastside Screens
Water
Major Rivers
Major Roads
Supplemental Draft EIS Area Border

INTERIOR COLUMBIA
BASIN ECOSYSTEM
MANAGEMENT PROJECT

Supplemental Draft EIS Area
2000

*The Inland Native Fish Strategy applies to lands administered by the USFS. Bull trout habitat on BLM-administered lands is managed according to BLM State Directors' Instructional Memorandum.

term strategy to be developed and evaluated for slowing the degradation and beginning the restoration of aquatic and riparian ecosystems for anadromous fish.

- **Eastside Screens.** *Interim Management Direction Establishing Riparian, Ecosystem, and Wildlife Standards for Timber Sales* (May 20, 1994; amended June 5, 1995; riparian standards replaced July 28, 1995): Calls for more definitive long-term direction for ecosystem-based management of timber sales on National Forests in eastern Oregon and Washington.
- **INFISH.** *Inland Native Fish Strategy* (July 28, 1995): Calls for long-term management direction to protect habitat and populations of resident native fishes outside anadromous fish habitat.

Biological Opinions on the Land and Resource Management Plans (LRMPs) as amended by PACFISH and INFISH (NMFS 1995, NMFS 1998, USFWS 1998) provide reasonable and prudent measures, implementing terms and conditions, and conservation recommendations. These Endangered Species Act requirements and recommendations, which are applicable to significant portions of the project area, are included in Alternative S1, Chapter 3, as part of the no-action alternative.

Decisions to be Made

This section discusses the management priorities under which the decision will be implemented and science considerations regarding the planning and decision-making framework. It also presents the nature of the decision to be made; and the relationship of the decision to other planning efforts, laws, and policy.

Management Priorities

In developing and implementing decisions, the Forest Service and BLM are guided by basic principles and priorities. Both the Forest Service and BLM are multiple-use agencies that promote the sustainability of ecosystems by ensuring their health, diversity, and productivity. Decisions resulting from this EIS and subsequent actions will be implemented under the three priorities outlined below:

- **Protecting Ecosystems.** The agencies work to ensure the health and diversity of ecosystems while meeting people's needs. Special care for fragile or rare ecosystem components is provided on lands administered by the Forest Service or BLM.
- **Restoring Deteriorated Ecosystems.** The BLM and Forest Service strive to improve deteriorated ecosystems on lands they administer, based on scientific understanding and emerging technologies.
- **Providing Multiple Benefits for People Within the Capabilities of Ecosystems.** Within the limitations of ecosystem integrity, health, and diversity, forests and rangelands must also meet people's needs for uses, values, products, and services.

Science Considerations

What Has Been Accomplished to Date

The Science Integration Team (SIT) prepared an *Integrated Scientific Assessment for Ecosystem Management in the Interior Columbia Basin and Portions of the Klamath and Great Basins* (Quigley, Haynes, and Graham 1996) and an *Assessment of Ecosystem Components in the Interior Columbia Basin and Portions of the Klamath and Great Basins* (Quigley and Arbelbide 1997), collectively known as the *Scientific Assessment*, and several other documents. The Science Team also created numerous databases and computer models. The databases contain information on vegetation, landform, climate, stream inventories, terrestrial species relationships, county indicators, and economic conditions. The models range from those that predict change in vegetation under different disturbance regimes to those that describe resiliency of human communities. Together, the documents, databases, and models provide the basis for an assessment of the project area, which was used by the EIS Team to describe the Affected Environment (Chapter 2).

Database/information systems/information gathering for the Interior Columbia Basin Ecosystem Management Project generally can be categorized into five groups:

- Databases (more than 20 were acquired or developed);
- GIS themes or layers (more than 180 were generated, see Appendix 2);
- Expert panels/workshops (approximately 40 were convened);

- Contract reports (more than 130 were used); and
- Current literature reviews.

The Science Integration Team developed an understanding of the status, condition, and trends associated with the components of the ecosystems and economies of the project area, from an ecological perspective. They characterized the landscape and vegetation components from a broad perspective, addressing those elements that have been altered during the past 100 years. They examined the successional and disturbance processes in an area together with landform, soil, water, and climate conditions that formed the native system in which plants and animals evolved. Terrestrial wildlife species and their habitats within the project area were characterized and examined from a broad perspective, bringing forward a reduced list of species that are likely to be at risk. The SIT also characterized and examined aquatic species and their habitats within the project area, drawing from information about species abundance, distribution, diversity, and habitat inferences.

Projections of risk to ecological integrity came from both a "functional" (that is, by individual resource components such as aquatics) and an integrated perspective. Elements that affect the aquatic, terrestrial, and landscape systems were identified using common databases and assumptions about the future. These findings and projections provide useful considerations for managers as they examine future options and establish management policies.

Additional Scientific Work Between the Draft EISs and the Supplemental Draft EIS

Between publishing of the Draft and Supplemental Draft EISs, additional information/analysis was provided by the Science Advisory Group. Several general technical reports were published by the Pacific Northwest and Rocky Mountain Research Stations. These documents contained additional information characterizing the biophysical, economic, and social conditions of the basin. Additional analysis on terrestrial vertebrates was completed and the results are summarized in the *Source Habitats for Terrestrial Vertebrates of Focus in the Interior Columbia Basin: Broad-scale Trends and Management Implications* (Wisdom et al. in press.) The Science Advisory Group completed an analysis and evaluation of the Supplemental Draft EIS alternatives to estimate likely outcomes and cumulative effects from the alternatives. This information was used to develop Chapter 4.

Decisions To Be Made Through This Planning Process

Decision Makers

The ICBEMP process is led by an Executive Steering Committee, which includes regional foresters; BLM state directors; Forest Service research station directors; and regional directors for the Environmental Protection Agency, National Marine Fisheries Service, and U.S. Fish and Wildlife Service. Although these officials meet almost monthly to steer the progress of the project, Forest Service and BLM officials are ultimately responsible for signing the Record of Decision and determining management direction for Forest Service- and BLM-administered lands.

Any alternative that is selected must meet the purpose of and need for the proposed action, described earlier in this chapter.

Before the Record of Decision (ROD) is signed, the Executives can decide to:

- Select one of the alternatives analyzed within the Final EIS, including the no-action alternative; or
- Modify an alternative (for example, combine parts of different alternatives).

Any alternative that is selected must meet the purpose of and need for the proposed action, described earlier in this chapter. The Executives can select from the alternatives presented in the Supplemental Draft EIS and from the alternatives presented in the Draft EISs. Further discussion on the status of the seven alternatives from the Draft EISs can be found in Chapter 3.

Scale of Decision

The broad-scale nature of this EIS does not include site-specific decisions. Those decisions will be made by local managers (BLM district managers, field office managers, and area managers; and Forest Supervisors and District Rangers) during finer-scale planning processes.

The broad-scale nature of this EIS does not include site-specific decisions. Those decisions will be made by local managers

Many decisions in this planning process are based on information and projections for periods longer than 10 years. The adequacy and completeness of some types of data at this scale require discussion under 40 CFR 1502.22 regarding incomplete or unavailable information. (This discussion is provided in Chapter 4.)

What the Decision Will Provide

The ICBEMP Record of Decision (ROD) will provide a large-scale ecological context for Forest Service and BLM land use plans. It also will help clarify the relationship of agency activities to ecosystem capabilities and will help develop realistic expectations for the production of economic and social benefits. Most of the decisions in the ROD will focus on regional and subregional issues and establish desired landscape patterns, structure, and succession and disturbance regimes to address the issues. The ROD also will help establish general direction for management of habitat for species or groups of species that require integrated management across broad landscapes to assure viability. For the most part, fine-scale decisions will be deferred to individual administrative units after appropriate site-specific NEPA analysis. Those decisions must be made within the context of the broad-scale direction in this EIS.

What the Decision Will Not Provide

Broad-scale decisions made through the ICBEMP Record of Decision will guide subsequent decisions made by local Forest Service and BLM managers. Many other decisions are not appropriately made at the scale, or within the scope, of this decision, and therefore will not be included in the ROD. Examples of these types of decisions include:

- *Statutory requirements.* The decision would not change the agencies' responsibility to comply with the Clean Air Act, Clean Water Act, Endangered Species Act, National Environmental Policy Act, or any other federal law.
- *National policy.* The decision would not change the agencies' obligation to conform with national policy. No change, for example, would be made in the requirement for all levels of planning activities to be conducted in close coordination with potentially affected American Indian tribes.
- *Specific allocations of resource products.* The allocation of allowable cut for timber or animal unit months (AUMs) of forage for livestock are made at the individual land use plan or activity plan level.
- *Funding levels and allocations.* The decision addresses broad-scale management direction (management intent, objectives, standards, and guidelines) not funding levels. Funding levels and allocations are made through separate administrative processes that are influenced by this decision but not directed by it.
- *Activity plan level decisions.* The amount and restrictions for grazing in a specific allotment will continue to be determined locally through NEPA compliance and allotment management plan development in consultation with affected parties.
- *Project plan level decisions.* Examples include: the actual types, location, and timing of treatments to eradicate noxious weeds; the location and timing of prescribed fire activities; the location and timing of road and trail maintenance and rehabilitation activities.
- *Administrative actions for which a land use plan decision is not needed.* For example, a Memorandum of Understanding regarding collaboration among the five federal agencies represented on the ICBEMP Regional Executives committee has been agreed to. Also, the agencies have collaborated on and prototyped a basin-wide protocol for addressing waters listed under Section 303(d) of the Clean Water Act.

Decision Elements

Specific decisions involved in the selection of an alternative include adoption of:

- Management goals;
- Management direction, including statements of *management intent, objectives* to be used in measuring progress toward attainment of the management goals, and *standards,* which are requirements to be used in designing and implementing future management actions;
- Geographic delineations, such as aquatic A1 and A2 subwatersheds and terrestrial T watersheds;
- A monitoring plan, mitigation measures, and other items to be documented in the ROD.

Guidelines, which are optional techniques that should prove useful in meeting the objectives, are also included in the decision. See Chapter 3 for more information on the alternatives and their components.

The alternatives, at this broad scale, do not specify the types or level of management activities (for example, acres of rangeland improvement or prescribed burning) that would be needed to achieve the objectives in Chapter 3. Instead, they describe the emphasis, intent, and desired outcomes for the different conditions and areas delineated within the project area. In addition, the EIS Team developed a possible implementation scenario to assist the Science Advisory Group in modeling the effects of the alternatives (see Appendix 14).

Decision Space

Decision space defines which decisions the deciding officials *can* make (including management actions and intensities on lands they administer) and *can not* make (including actions on lands they do not administer, or decisions assigned to another agency).

Various federal and state laws—such as the Clean Water Act, Clean Air Act, Endangered Species Act, and National Forest Management Act—have minimum requirements or conditions (thresholds) that must be attained prior to or while conducting management activities. While these thresholds may define the lower limits of a decision space, the upper limit is often bounded by the biological potential, or maximum capabilities of the land and resources. This allows for a range of management options between the thresholds and the biological potential. Selection of a preferred alternative within that range of management options can then be focused on social, economic, or natural resource considerations. In general, a combination of social, economic, and resource values will be best achieved somewhere short of maximizing any one value.

How the Decision Would Affect Existing Land Use Plans and Other BLM/Forest Service Direction

Regional Guides and Policy Directives

Some of the guidance recorded in the Record of Decision that applies across the ICBEMP project area as a whole or to each administrative unit will be transmitted to local agency managers in the form of amended Regional Guides (Forest Service only; BLM does not have a mandatory level of planning that parallels the Forest Service Regional Guides) or in appropriate policy directives. This guidance may include, but not be limited to: adoption of a set of goals for management; direction for adaptive management and collaboration; accountability of agency managers for implementing the decision; requirements for monitoring; and direction for application of ecosystem management concepts, including the multi-scaled, hierarchical analysis process this project has referred to as 'Step-Down'. The bulk of the direction in the ROD will be transmitted to local agency managers in the form of amended land use plans.

Management direction and land allocations in existing plans not directly superseded by the ICBEMP Record of Decision will remain in effect. Generally, this would include site-specific direction, such as location and timing of activities, and direction for Congressionally designated areas, such as Wild and Scenic River areas.

Amendments to Land Use Plans

The scale of the *Scientific Assessment* and this EIS is broad enough that it is neither feasible nor appropriate to make fine-scale amendments to land use plans; however, it is both feasible and appropriate for the EIS to make broad-scale amendments to land use plans.

Individual federal land use plans will be amended upon signing of the ROD. Management direction from the ICBEMP ROD, which becomes part of the amended plans, will guide activity-level decision-making until replaced through subsequent amendment or revision. Management direction and land allocations in existing Forest Service and BLM plans not directly superseded by the ICBEMP Record of Decision will remain in effect. The Record of Decision also may change planning schedules and funding priorities, and will identify necessary changes to policy or suggest modifications to existing laws as needed to implement the decision.

In both agencies, topics such as planning criteria, inventory data and information collection, analysis of management situation, and formulation of alternatives are controlled by the issues identified in scoping. The ICBEMP accomplished all of the steps in the Forest Service's significant amendment process as appropriate in estimating effects of alternatives, evaluation of alternatives, and selection of an alternative.

Fundamentals of Rangeland Health

1. Watersheds are in, or are making significant progress toward, properly functioning physical condition, including their upland, riparian-wetland, and aquatic components. Soil and plant conditions support infiltration, soil moisture storage, and the release of water that are in balance with climate and landform and maintain or improve water quality, water quantity, and timing and duration of flow.

2. Ecological processes, including the hydrologic cycle, nutrient cycle, and energy flow, are maintained, or there is significant progress toward their attainment in order to support healthy biotic populations and communities.

3. Water quality complies with state water quality standards and achieves, or is making significant progress toward achieving, established BLM management objectives, such as meeting wildlife needs.

4. Habitats are, or are making significant progress toward being, restored or maintained for federally threatened, endangered, proposed, candidate, and other special status species.

Source: 43 CFR 4180.1 and 60 FR 9894.

Interim Direction

The project area overlaps part or all of the land addressed in the Decision Notices for PACFISH, Eastside Screens, and Inland Native Fish Strategy (see Map 1-3, earlier in this chapter). As directed in the project charter, the ICBEMP Record of Decision will replace those interim strategies. This would include direction for both terrestrial and aquatic ecosystems.

Rangeland Health

The alternatives analyzed in this EIS include management direction intended to complement or support, rather than replace, Standards for Rangeland Health and Guidelines for Livestock Grazing Management (August 12, 1997), known as the Healthy Rangelands Initiative. These standards and guidelines were developed by the BLM state directors of Oregon/Washington, Idaho, and Montana in consultation with the affected Resource Advisory Councils (RACs) and Provincial Advisory Committees (PACs) in those states. They were approved by the Secretary of the Interior in August 1997 and are being implemented in each of the four states in the project area. The alternatives analyzed in this EIS incorporate the principle that cumulative effects of all management activities, including federally authorized activities, determine whether the standards for rangeland health will be achieved. Consequently, the effects of livestock grazing are not the only concern.

Healthy Rangelands Standards and Guidelines were developed to provide for conformance with the fundamentals of rangeland health (see box), defined in BLM's grazing administration regulations (43 CFR 4180), published in the *Federal Register* on February 22, 1995 (60 FR 9894).

Healthy Rangelands standards and guidelines are presented in Appendix 13.

Relationship to Other Planning Efforts, Law, and Policy

Lands Affected by the Decision

The ICBEMP decision would provide direction only for public lands administered by the Forest Service or the BLM in the project area. The Record of Decision based on this EIS would make no management decisions for state, local (city or county), tribal, or private lands in the project area.

Valid Existing Rights

To the extent provided by law, nothing in this plan can override valid existing rights on Forest Service- or BLM-administered lands. However, to meet the objectives of an alternative, some reasonable changes may be required in the way activities are carried out.

Other Planning Efforts (Federal, State, Tribal, and Local)

Federal laws, regulations, and policies require consideration of other planning efforts when developing a management plan such as the ICBEMP.

The Council on Environmental Quality regulations in 40 CFR 1502.16(c) require a discussion of possible conflicts between the selected alternative and the objectives of federal, regional, state, and local (and, in the case of a reservation, tribal) land use plans, policies, and controls for areas concerned. BLM planning regulations require its resource management plans be consistent with officially approved or adopted resource-related plans, and the policies and programs contained therein, of other federal agencies, state and local governments, and Indian tribes, so long as the resource management plans would still be consistent with applicable federal laws and regulations (43 CFR 1610.3-2). The Federal Land Policy and Management Act and National Forest Management Act require that federal land management agency plans identify consistencies and inconsistencies with other land use plans, such as planning and zoning efforts of local governments.

One effort undertaken during the planning process was to consider consistency of the selected alternative with local planning efforts and involved the collection and review of many county land uses, economic developments, and other plans. A summary report, the *County/Community Vision Statement Project* (Frewing-Runyon 1995) reviewed 32 such plans for the Interior Columbia Basin Ecosystem Management Project. The Eastside Ecosystem Coalition of Counties assisted project staff by requesting that local governments in the project area provide copies of their plans for review. State and tribal plans also were considered when analyzing cumulative effects.

Federal, State, and Local Environmental Protection Laws and Policies

Federal Laws

Federal management decisions must be consistent with federal laws, including the Federal Land Policy and Management Act, National Forest Management Act, Endangered Species Act, the American Indian Religious Freedom Act, National Historic Preservation Act, the Clean Air Act, and Clean Water Act (see Appendix 1 for a list of federal laws that are most relevant to this EIS). The ICBEMP EIS was developed under this premise.

Roadless Area Policies

Inventoried roadless areas are National Forest System lands of 5,000 acres or more characterized by their undeveloped state. The equivalent BLM roadless areas are termed wilderness study areas (WSAs). Following the nationwide Roadless Area Review and Evaluation (RARE and RARE II) efforts in the 1970s, inventory of unroaded areas resulted in some inventoried roadless areas being recommended for inclusion in the National Wilderness Preservation System. Congress enacted wilderness legislation for a number of areas in Oregon and Washington in 1984, prior to completion of land use plans. No similar legislation has been enacted by Congress for Idaho and Montana, leaving unroaded areas to be allocated to a variety of uses through land use planning. As a result, road development and resource extraction has occurred in some inventoried roadless areas.

The alternatives do not change the existing land allocations of Forest Service inventoried roadless areas or Bureau of Land Management wilderness study areas. Proposed changes to the status of inventoried roadless areas is appropriately addressed through the land use planning process or through new executive or congressional direction.

On October 19, 1999, the Department of Agriculture, Forest Service, filed a Notice of Intent in the Federal Register (Vol.64, Number 201, pages 56306-56307) to prepare an environmental impact statement (EIS). The Forest Service is initiating a public rulemaking process to propose the protection of remaining roadless areas within the National Forest System. To assist in determining the scope and content of a proposed rule, the agency will prepare an EIS to analyze: (1) the effects of eliminating road construction activities in the remaining unroaded portion of inventoried roadless areas on the National Forest System; and (2) the effects of establishing criteria and procedures to ensure that the social and ecological values that make both inventoried roadless areas and other uninventoried roadless lands important are considered and protected through the forest planning process. A draft EIS and proposed rule are expected to be available for public review and comment in spring 2000 and a final EIS and final rule will follow.

The ICBEMP Supplemental Draft EIS addresses the values of unroaded lands (including inventoried roadless) relative to certain aquatic and terrestrial values thus addressing a subset of the social and ecological values spoken to in the Notice of Intent. Appropriate and necessary connections will be maintained as progress is made on completing both the ICBEMP EIS and the Forest Service roadless protection EIS.

State and Local Environmental Programs

Some federal laws contain provisions for state administration of specific environmental programs or for making state laws applicable to federal lands and facilities. The intent of the ICBEMP Record of Decision is to comply with these legal requirements. Compliance can be assured at finer-scale planning levels.

Endangered Species Act

Consultation

Under Section 7 of the Endangered Species Act and related Secretarial Order 3206, federal activities that may have an effect on threatened or endangered species are subject to consultation with the U.S. Fish and Wildlife Service (USFWS) or National Marine Fisheries Service (NMFS). Requirements for consultation will remain in effect under any alternative selected.

Formal consultation under Section 7 of the Endangered Species Act with the U.S. Fish and Wildlife Service and the National Marine Fisheries Service will be initiated before any decisions are made on the basis of this EIS and prior to any ground-disturbing activities. If the selected alternative may have an effect on threatened or endangered species, then biological assessment(s), appropriate to the scale of the decision, will be submitted to the USFWS and NMFS for consultation and preparation of a Biological Opinion. The Biological Opinion on the ICBEMP selected alternative will replace the three biological opinions recently completed on the Land and Resource Management Plans as amended by PACFISH and INFISH (NMFS 1995, NMFS 1998, USFWS 1998).

The NMFS and U.S. Fish and Wildlife Service will continue to coordinate with the Forest Service and BLM regarding implementation of the selected broad-scale ICBEMP management strategy. In addition, on-the-ground impacts and incidental take will be assessed in subsequent, finer-scale decision-making processes before site-specific actions are implemented.

The federal agencies involved in ICBEMP are continuing to discuss implementation issues that may play an important role in the Endangered Species Act consultation/conferencing process for listed and proposed species. Key implementation issues could require clarification of management guidance to achieve the desired outcomes of the selected alternative and may be addressed prior to or in the Record of Decision: (1) whether the tools used in conducting step-down processes, such as Subbasin Review, need refinement; (2) how to refine and use specific, measurable indicators of existing and future watershed condition; (3) how to ensure management direction and priorities reflect existing information (for example, priority watershed data) and can be adjusted in response to new scientific information that help meet Endangered Species Act objectives; (4) how project analyses and decisions incorporate ecologically appropriate Riparian Conservation Area delineation criteria; and (5) how to organize an implementation organizational structure to assure that ICBEMP will be implemented as described and that successful techniques are replicated (see Appendix 10).

The Biological Opinion on the selected alternative will replace the three biological opinions recently completed on the Land and Resource Management Plans as amended by PACFISH and INFISH.

The consultation process will also need to explore the transition into implementation of the selected alternative and the extent to which elements of the no-action alternative (Alternative S1) should be retained (beyond that already incorporated into Alternative S2 as interim direction) while technical tools and implementation guidance are being completed. This is particularly relevant to the transition from current direction of PACFISH, INFISH, and the Biological Opinions to a long-term management strategy. Consultation will benefit, as will alternative selection, from public comment on the entire Supplemental Draft EIS, including comment on issues in implementation and transition.

Recovery Plans

Recovery plans are technical scientific documents which identify specific actions to conserve and recover a particular species, and describe methods to implement these actions. Recovery plans are formulated and carried out by a recovery team, which is usually composed of biological experts from tribes; federal, state, and local agencies; and in some cases the private sector. The recovery plan process is one of the key focal points of the Secretary of the Interior's efforts to conserve and recover listed species under the Endangered Species Act of 1973, as amended. The intent of the ICBEMP decision is to require actions to be tiered to approved recovery plans or conservation strategies if the action is determined to potentially affect a listed species with an approved plan or strategy. Appendix 6 lists the plant, animal, and fish species that have an approved recovery plan in the project area.

Environmental Justice

Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations" (February 11, 1994), and subsequent guidance from Council on Environmental Quality set procedures that are to be met by federal agencies. When writing an EIS, federal agencies are to consider whether there are disproportionately high and adverse environmental or human health effects, including social and economic effects, on identifiable low-income or minority populations (which includes American Indian tribes). Elements that should be considered include destruction or disruption of developed or natural resources; destruction or disruption of community cohesion or a community's economic vitality; and the denial, reduction in, or significant delay in the receipt of benefits of federal programs or activities.

In preparation of this EIS, consideration was given to whether the alternatives would subject identifiable low-income or minority populations to disproportionately high and adverse environmental, human health, social, or economic effects. Social and economic effects on economically specialized and isolated communities were analyzed and are reported in the Social-Economics-Tribal Section of Chapter 4. In addition, effects specific to American Indian tribes (see below) are discussed in the Federal Trust Responsibility and Tribal Rights and Interests subsection of Chapter 4. The Executive Steering Committee considered these effects when selecting the preferred alternative.

Federal Trust Responsibilities to Indian Tribes

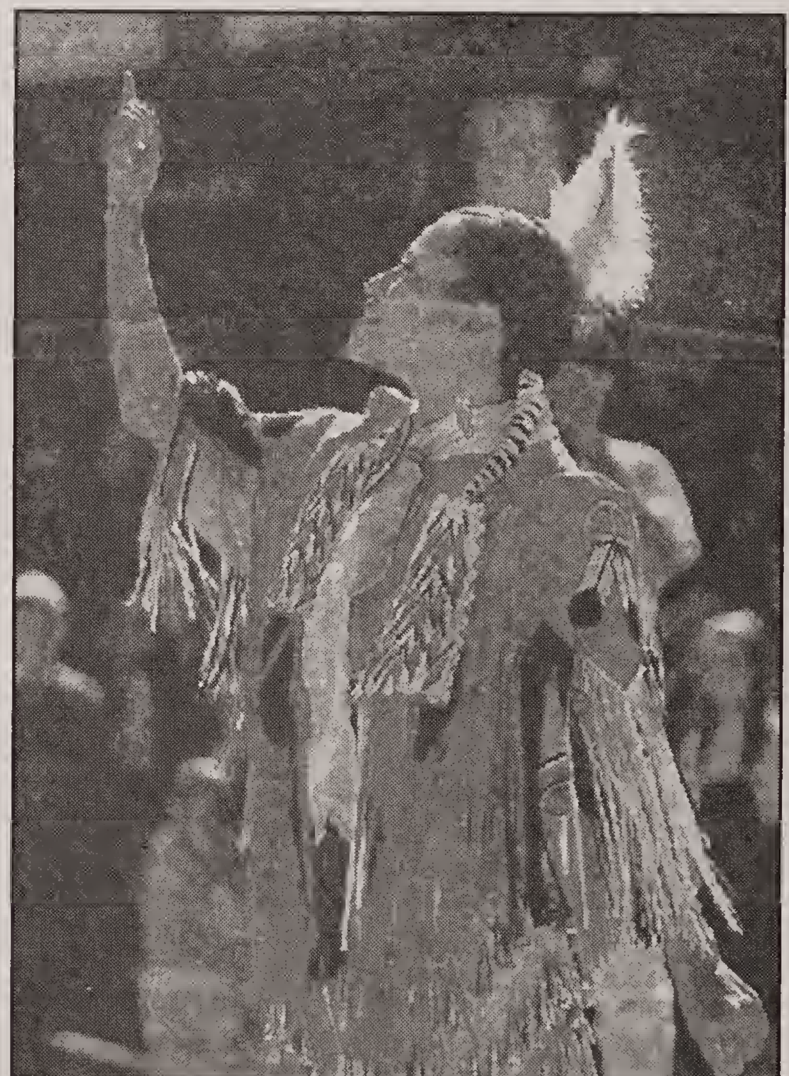
There are 22 federally recognized American Indian tribes with interests in the Interior Columbia Basin Ecosystem Management Project area. The federal government has a trust and legal responsibility to American Indian tribes, which comes from commitments made by the United States in treaties, executive orders, statutes, and agreements. Upholding these specified tribal rights constitutes the federal government's legal responsibility. The federal government also has a responsibility to consult with affected tribes whenever its actions affect the resources upon which tribal hunting, fishing, gathering, and grazing rights depend. It is the intent for the ICBEMP Record of Decision to honor and uphold these federal trust responsibilities to Indian tribes.

The project area now includes all or part of 93 counties in four states; 22 tribes have interests in the project area.

The tribes that have interest in the project area are listed in Chapter 2. Other discussions of American Indian tribes are provided in Chapter 2 and in Appendix 8.

Water Quantity

Outcomes predicted in this EIS assume the availability of instream flows that are sufficient to maintain and restore channel conditions, provide for viable aquatic species such as fish, protect recreation flows in wild and scenic river areas, and provide for other needs. The continued availability of instream flows is critical to successful resource management; if sufficient water is not available to allow management of public lands as intended, the consequences of the selected alternative may be different from those described in Chapter 4. Although the broad-scale nature of this EIS does not lend itself to prescribing



It is the intent of the ICBEMP to honor and uphold federal trust responsibilities to Amercian Indian tribes.

minimum instream flows, finer-scale planning documents (such as land use plan amendments or revisions, and activity plans) can more accurately address instream flows.

Public Participation

The ICBEMP EIS was developed with extensive public participation, exceeding the "minimum" required by the National Environmental Policy Act (NEPA). A summary of public participation activities for this project follows. Further details may be found in Appendix 3 and in the Project Planning Record.

The ICBEMP aims to provide for people's uses and values of natural resources consistent with maintaining healthy, diverse ecosystems.

Notice of Intent and Scoping

The scoping process required by NEPA implementing regulations (40 CFR 1501.7) was conducted to invite public participation, encourage an open process, and determine the significant issues to be addressed. The Forest Service and BLM sought information, comments, and assistance from federal, tribal, state, and local agencies, and from other groups and individuals interested in or affected by the proposed action.

The formal scoping period for the Eastside Draft EIS opened with publication of the Notice of Intent to produce an environmental impact statement, which first appeared in the *Federal Register* on February 1, 1994 (59 FR 4680). The notice was revised May 23, 1994 (59 FR 26624), to add BLM-administered lands in southeastern Oregon. The formal scoping period for the UCRB Draft EIS opened with publication of the Notice of Intent in the *Federal Register* on December 7, 1994 (59 FR 63071). The Notice of Intent was revised August 25,1995 (60 FR 44298) to correct the expected publication date for the Draft EIS.

The scoping process and the public comments received during the scoping period were summarized in the Draft EISs (see Draft EIS Chapter 1, Eastside Appendices 1-3 and 1-4, and UCRB Appendix D) and are outlined in Appendix 3 in this Supplemental Draft EIS.

Public Comment on the Draft EISs

On June 6, 1997, the Eastside and Upper Columbia River Basin Draft EISs were released for public review, initiating a formal 120-day comment period (62 FR 31098 and 62 FR 32076). After several requests from the public for more time to review the Draft EISs, the project's Executive Steering Committee extended the comment period from October 6, 1997, to February 6, 1998 (62 FR 46941). In January 1998, the comment period was extended again to April 6, 1998, in response to additional project requirements included in the 1998 Department of the Interior and Related Agencies Appropriations Act (63 FR 3533). In March 1998, the ICBEMP released a report on the economic and social conditions of several hundred communities in the Pacific Northwest. The comment period was extended an additional 30 days to give people time to review and submit comments on the new report (63 FR 13619). The final close of what became a 330-day comment period was May 6, 1998. Some 82,895 people, organizations, or agencies submitted comments either by letter/postcard or via the Internet.

A process known as 'Content Analysis' was used to compile, correlate, and summarize comments into a format usable by the EIS Team and decision makers. All comments were considered, with an emphasis on the *content* of the comment rather than the *number of*

times a particular comment was received. A complete report, *Final Analysis of Public Comment for the Eastside and Upper Columbia River Basin Draft Environmental Impact Statements* was prepared by the national Forest Service Content Analysis Enterprise Team in October 1998. The report contains details on the content analysis process; an analysis of issues, concerns, and comments organized by theme or topic; and demographic information on the origin and method of responses. This information is summarized in Appendix 4.

Ecosystem-based management stresses the integration and interrelationships of all parts and functions of an ecosystem, including the human component.

The Council on Environmental Quality regulations for implementing the National Environmental Policy Act require federal agencies to assess and consider comments both individually and collectively and respond in the Final EIS. Possible responses are to: (1) modify alternatives including the proposed action; (2) develop and evaluate alternatives not previously given serious consideration by the agency; (3) supplement, improve, or modify the analysis; (4) make factual corrections; or (5) explain why the comments do not warrant further agency response.

Rather than wait until publication of the ICBEMP Final EIS, the summarized public comments on the Draft EISs and agency responses are presented in Appendix 4 in the Supplemental Draft EIS. These comments were used extensively while preparing this EIS. Comments received during the comment period for the Supplemental Draft EIS will be presented and responded to in the Final EIS.

Coordination With Other Agencies and Governments

During preparation of both the Draft EISs and the Supplemental Draft EIS, the EIS Team used a collaborative approach with the Science Integration Team/ Science Advisory Group and with federal and state agency staff and elected officials from state, county, and tribal governments, to develop and analyze the ecosystem-based strategies for management of lands in the project area administered by the BLM or Forest Service. See Chapter 5 for lists of those contacted.

Federal and State Agencies

The EIS Team is made up of personnel from the BLM and Forest Service, with liaisons from the U.S. Fish and Wildlife Service, National Marine Fisheries Service, and Environmental Protection Agency. Other federal agencies involved included the Bureau of Mines, U.S. Geological Survey, and the Bureau of Indian Affairs. Federal cooperating agencies were the Bureau of Reclamation, Bonneville Power Administration, and National Park Service. (Cooperating agencies are defined as federal agencies that have legal jurisdiction or special expertise with respect to environmental issues addressed in the EIS.)

Project personnel contacted various state agencies and representatives of the governors for Idaho, Montana, Oregon, Washington, Wyoming, Nevada, and Utah to ensure state concerns were incorporated into the Draft EISs. State agencies with responsibility for fish, wildlife, forestry and natural resources, air, and water were involved in these dialogues, along with senior natural resource advisors and officials. The project received written comments on the Draft EISs from governors, agency heads, or legislative bodies from each of the states involved. Coordination has continued with state personnel of Idaho, Montana, Oregon, and Washington during development of the Supplemental Draft EIS.

Tribal Governments

Early in the project, the ICBEMP Tribal Liaison Group contacted 22 tribal governments, representing numerous tribes that reside within or have rights and interests in the ICBEMP project area. The purpose of the contact was to help develop, based on a government-to-government relationship, a consultation process with each tribal government and to work closely and continuously with each other to integrate tribal rights and interests in the planning process.

Early tribal involvement and consultation in such a complex project as the Interior Columbia Basin Ecosystem Management Project was a relatively new undertaking. All the tribal governments participated to varying degrees and at various times, based in part on differing interpretations of the concepts of "involvement" and "consultation" (see Chapter 2, Tribal Rights and Interests Section). All the tribal governments provided at least informal feedback and made significant early contributions to this process. Some engaged in formal government-to-government consultation and provided comments on the Draft EIS.

Five tribal summit meetings were scheduled for consultation with representatives of the 22 tribal governments on a government-to-government basis. Three summits were held with representatives of the eight tribal governments that chose to participate. A Tribal/Executive Steering Committee Working Group was formed as a result of a meeting between the Secretary of the Interior, federal representatives, and representatives of 10 of the 22 affected tribal governments. The Tribal Working Group's charge was to identify and work toward mutual resolution of tribally identified basin-wide issues.

County Governments

The project area now includes all or part of 93 counties in four states (the Draft EISs included 100 counties in seven states). The Eastside Ecosystem Coalition of Counties (EECC) facilitated the involvement of counties, assuring that county interests and input were considered by the Science Advisory Group and the EIS Team.

The coalition was jointly formed in 1994 by the Association of Counties from Idaho, Montana, Oregon, and Washington. This coalition participated actively throughout the process. In September 1995, a Memorandum of Understanding (MOU) was signed between the ICBEMP and the EECC outlining communications and other opportunities for the counties to provide advice and recommendations to the project; the MOU was updated in 1997 (EECC and ICBEMP 1997). Project officials met on numerous occasions with the EECC, State Associations of Counties, and individual boards of county commissioners, on request, including counties in states not represented by the EECC. Many county representatives, including the EECC, submitted written comments on the Draft EISs.

What's Next in the Planning Process

The next step in this process is to gather and analyze public comment on this Supplemental Draft EIS. The EIS Team will then prepare the Final EIS, responding to public comments on the Supplemental Draft. The decision makers will review the environmental effects of the alternatives and the public comment, and they will select an alternative to implement. This decision will be recorded in a public Record of Decision (ROD).

Planning Issues

In early stages of the project, scoping was used to identify the issues and concerns people have about public lands managed by the BLM or Forest Service in the project area. This information was collected for several reasons:

- To help identify what data should be collected for the EIS.
- To help develop ecosystem management alternatives for the EIS.
- To help identify environmental consequences that should be addressed in the EIS.

An "issue" for planning purposes is defined as a matter of controversy, dispute, or general concern over resource management activities or land uses. To be considered as a "significant" planning issue, it must be well defined, relevant to the proposed action, and within the agencies' ability to address in the formulation and analysis of alternatives, or through possible mitigation measures. Other factors used to identify significant issues include the geographic extent of the issue, how long the issue is likely to be of interest, and the intensity of the level of interest or conflict generated by the issue.

Significant broad-scale issues identified during scoping and/or brought forward during public comment on the Draft EISs were considered in the preparation of the Supplemental Draft EIS. Many of the issues that are more appropriately addressed at a finer scale were incorporated into the step-down process. For example, an issue regarding opportunities for cultural, recreational, and aesthetic experiences was raised during scoping. That issue would be better addressed at a finer scale than the revised focus of this Supplemental Draft EIS (limited to critical and compelling broad-scale issues); therefore, it has been dropped from this EIS and will be addressed during finer scale programmatic planning and decision-making processes.

The concepts of ecosystem-based management stress the integration and interrelationships of all parts and functions of an ecosystem, including the human component. The issue statements listed here exhibit the integration and interdependence of all resources in each issue. Each issue addresses only those lands and resources administered by the BLM or Forest Service in the project area. The paragraphs following the issues represent some of the comments received from the public and are intended to illustrate the range of public opinion. For the sake of brevity, and

to illustrate the wide range of opinion on either end of the spectrum, many diverse opinions are included here. Many public comments received were actually within these extremes. Appendix 4 summarizes public comments on the Draft EISs in more detail and discusses the responses to public comments.

Issue 1: In what condition should ecosystems be maintained?

People have varying opinions about what level of human alteration of the landscape and natural systems is acceptable, whether change should be measured against current or historical conditions, what time period to consider for historical conditions, and what the desired range of conditions are and how those conditions should be achieved. Many people prefer restoring ecosystem conditions to those that existed naturally (historical ranges of variability), prior to the extensive impacts of human development on natural systems. Others feel that people are an integral part of ecosystems; therefore, anything people do is part of ecosystem function and should be allowed, provided that outputs can be sustained over time and provide revenue and employment. Some people also feel that federal land management should compensate for a lack of functioning ecosystem conditions on some private lands. Concerns were expressed over the ability to understand ecosystems or their resiliency or the appropriateness of specifying management for any one static condition or point in time because ecosystems are dynamic. Public comments on the Draft EISs reaffirmed that this is still an issue of concern.

Issue 2: To what degree, and under what circumstances should restoration be active (with human intervention) or passive (letting nature take its course)?

Some people believe that the primary function of public lands is as reservoirs for biological resources, and therefore should be undisturbed, allowing "nature to take its course." Others believe public lands should be used to the fullest extent, as long as productivity and other biological functions are sustained. Several viewpoints were expressed during scoping as well as during the comment period on the Draft EISs regarding active and passive management:

- Active management is desirable.
- Active management is desirable, but not all management techniques are acceptable.
- Active management is desirable in some areas, but should be limited to areas that are currently roaded.
- Passive management is the only acceptable strategy; human management and intervention is what caused current problems in the first place.
- Neither active nor passive management alone is adequate; restoration should be approached slowly, using appropriate tools at various times and using extensive monitoring to deal with scientific uncertainty and changing conditions or knowledge.

Issue 3: What emphasis will be assigned when trade-offs are necessary among resources, species, land areas, and uses?

Federal land managers have long operated under the multiple-use philosophy, but controversy exists over dominance of particular uses and how these uses are distributed over time and space. Some of these conflicts include consumptive vs. non-consumptive uses, use of roads for access vs. closing roads to mitigate adverse impacts on various parts of the ecosystem, and taking care of the environment regardless of cost vs. spending only what is necessary to restore damaged areas. Other matters of controversy include which areas should receive priority; which resources and/or resource uses should receive priority; what amount of protection (including cost) is necessary for threatened, endangered, proposed, candidate, and special status species recovery; and how much weight should social and economic costs and concerns be given regarding species protection and natural resource management. Public comments on the Draft EISs reaffirmed that this is still an issue of concern.

Issue 4: To what degree will ecosystem-based management support economic and/or social needs of people, cultures, and communities?

Some people believe the federal government has an obligation to support the economic vitality of certain rural communities through predictable access to resources on public lands. Others believe there is no mandate to contribute to rural communities, and access should not be guaranteed. Some people feel public lands should continue to support the creation and maintenance of jobs, while others believe that jobs should not drive public land management. Some

people expressed a concern that a regional ecosystem approach will mask local economic and community impacts. Controversy exists over a balance between healthy ecosystems and levels and types of commodities and jobs. Another difference of opinion comes from potential effects of land management decisions on private lands. Some people view ecosystem-based management as a federal government attempt to control private lands, while others see necessity in considering all ownerships and resources when developing public land management strategies. Issue 4 was such an important issue during the comment period on the Draft EISs, that the Congress required the project staff to provide more information on effects of the alternatives on communities. *Economic and Social Characteristics of Communities in the Interior Columbia Basin* (ICBEMP 1998) was produced in response.

Issue 5: How will ecosystem-based management incorporate the interactions of disturbance processes across landscapes?

Some people feel wildfire suppression has resulted in conditions that contribute to larger, more intense fires and support the use of prescribed fire as a management tool. Others are concerned that prescribed fires sometimes get out of control. Many concerns were expressed regarding trade-offs between wildfire and prescribed fire, particularly with regard to air quality and visibility as they relate to smoke. There is disagreement over the role that fire, insects, disease, and other disturbance processes play in ecosystem function, and there are questions about how historical disturbance levels could be known. Other controversies include the effects of fire on private property in wildland-urban interface areas, whether timber harvest can or should resemble natural disturbances, whether disturbances should be controlled to allow for crop yields or other considerations, and the costs and benefits of logging. Public comments on the Draft EISs reaffirmed that this is still an issue of concern.

Restoring and maintaining healthy rangelands is an integral focus of the ICBEMP.

Issue 6 (formerly Issue 7): How will ecosystem-based management contribute to meeting treaty and trust responsibilities to American Indian tribes?

Federally recognized tribes have critical interest and/or rights associated with significant portions of land administered by the BLM or Forest Service. Some of these American Indian tribes retain rights which were reserved under treaties and other agreements negotiated with the United States government. Tribal rights and interests in the management of resources sometimes conflict with the interests of other groups and cultures. Some commentators feel that all groups, including tribes, should be given equal consideration, while other people believe the federal government should prioritize the resource needs of American Indians over others' needs.

Certain specific issues with respect to the ICBEMP were of deep concern to American Indian tribes, many of which were confirmed during the comment period on the Draft EISs. These concerns are described in

more detail in the Social-Economic-Tribal Section of Chapter 2 and include the following considerations:

- Treaty/Federal Trust Responsibility;
- Harvestability as Soon as Possible (ASAP);
- Basin-wide Habitat Standards;
- Interagency and Intergovernmental Coordination/Collaboration;
- Monitoring and Accountability;
- Government-to-government Collaboration/ Consultation;
- Implementation Funding; and
- Tribal Economics and Unemployment.

Tribes assert that standards need to be enforceable, measurable, and accountable; they feel that standards should not just advocate more assessment processes. The concern is that standards ensure full protection of high quality habitat and restoration of degraded habitat, especially fish habitat.

Issue (formerly Issue 6): What types of opportunities will be available for cultural, recreational, and aesthetic experiences?

Some people value public lands for their natural beauty and open spaces for current and future generations, or simply to allow wildlife a place to exist. Others value public lands for the commodities that help to sustain their lifestyle, such as timber for loggers. People become attached to places that have special meaning to them, but some people's preferences conflict with others. For example, a special place for American Indian spiritual use may not be compatible with a place for off-highway driving for pleasure. There is considerable debate on whether the cultural characteristics and traditional practices of distinctive groups should be sustained. Increases in human population and other social factors create pressures on locations close to public lands, which is a concern to many.

Issue 6 is finer-scale than what was intended for this Supplemental Draft EIS's refocus on critical and compelling issues that need to be addressed at the broad scale. Therefore, it is being dropped as an issue for this EIS and will be further addressed during finer-scale programmatic planning and decision-making processes.

Other Concerns and Planning Considerations

Many other topics and concerns were received during the scoping and Draft EIS comment periods. Concerns that related to development and implementation of the EIS, public participation, consultation and coordination, and other parts of the Interior Columbia Basin Ecosystem Management Project were considered during the development of the EIS. A brief description of concerns and planning considerations that were brought up during project scoping for the Eastside Draft EIS can be found in the *Preliminary Issues for the Development of Alternatives* paper (November 7, 1994) and for the UCRB Draft EIS can be found in that document's Appendix D. Detailed discussion of public comments received on the Draft EISs is provided in the *Final Analysis of Public Comment for the Eastside and Upper Columbia River Basin Draft Environmental Impact Statements* (October 1998; available by contacting the Walla Walla or Boise project office). Substantive comments from the public comment period and the project's response can be found in Appendix 4.

Availability of Planning Records

The ICBEMP EIS Planning Record includes data, documentation, and information used to prepare this analysis.

Documents may be requested from or viewed at the Interior Columbia Basin Ecosystem Management Project offices in Walla Walla, Washington, or Boise, Idaho. Local management plans and inventories are available at applicable BLM and Forest Service offices.

For more information please call either project office:
Walla Walla—(509) 522-4030, (509) 522-4029 (tty), fax (509) 522-4025; or
Boise—(208) 334-1770, fax (208) 334-1769;

Or visit the project Internet website:
http://www.icbemp.gov

Chapter 2

Affected Environment

Contents

Introduction to Chapter 2

Key Terms Used in This Section

Basin — In this EIS, refers to the Interior Columbia Basin Ecosystem Management Project area, including the project area (Forest Service- and BLM- administered lands) and other ownerships, as difined in the *Scientific Assessment.* (Quigley and Arbelbide 1997).

Current period —The current period depicts general conditions in the project area representative of the period between 1985 and 1995, approximately.

Ecological Integrity — In general, ecological integrity refers to the degree to which all ecological components and their interactions are represented and functioning; the quality of being complete; a sense of wholeness. Areas of high integrity would represent areas where ecological functions and processes are better represented and functioning than areas rated as low integrity.

Ecological Reporting Unit (ERU)—A geographic mapping unit developed by the Science Integration Team (currently referred to as the Science Advisory Group) to report information on the description of biophysical environments, the characterization of ecological processes, the discussion of past management activities and their effects, and the identification of landscape management opportunities.

Historical range of variability (HRV) —The natural fluctuation of ecological and physical processes and functions that would have occured in an ecosystem during a specified previous period. In this EIS, refers to the range of conditions that are likely to have occurred for several centuries prior to settlement of the project area by people of European descent (approximately the mid 1800s), which would have varied within certain limits over time. HRV is discussed only as a reference point, to establish a baseline set of conditions for which sufficient scientific or historical information is available to enable comparison to current conditions.

Historical period —The historical period is reflected by information recorded during the early decades of Euro-american settlement of the basin (approximately the mid 1800s), prior to major changes caused by this settlement and by subsequent patterns of use.

Hydrologic Unit Code (HUC) —A hierarchical coding system developed by the U.S. Geological Service to identify geographic boundaries of watersheds of various sizes.

Project Area — In this EIS, refers to the entire Interior Columbia Basin Ecosystem Management Project area, encompassing both the "Eastside" and "Upper Columbia River Basin" planning areas as described in the Draft EISs, *minus* the areas removed from the decision space (Nevada, Utah, Wyoming, and the area that overlaps the Northwest Forest Plan) as described in Chapter 1.

Resource Advisory Council/Provincial Advisory Committee (RAC/PAC) Area — Resource Advisory Councils (RACs) were established by the BLM to provide a forum for non-federal partners to engage in discussion with BLM managers regarding management of federal lands. Provincial Advisory Committees (PACs) were established by the Forest Service, under the Northwest Forest Plan, to provide a forum for non-federal groups and individuals to advise and make recommendations to federal land managers regarding management of federal lands. There are 12 RAC or PAC areas in the project area. Each area has its own advisory council or committee.

Subbasin —A drainage area of approximately 800,000 to 1,000,000 acres, equivalent to a 4th-field Hydrologic Unit Code (HUC). Hierarchically, subwatersheds (6th-field HUC) are contained within a watershed (5th-field HUC), which in turn is contained within a subbasin (4th-field HUC). This concept is shown graphically in Figure 2-1.

Introduction

This Introduction describes the purpose and organization of Chapter 2 and how information was gathered and presented. In addition, it provides discussion of basic ecosystem concepts for a better understanding of the rest of the chapter and the rest of the EIS. These concepts include historical range of variability, ecological processes and functions, and ecological integrity and ecosystem health. Finally, the Introduction closes with a discussion of positive ecological trends that have occurred over the past 10 to 20 years on Forest Service- and BLM-administered lands.

Purpose and Organization of Chapter 2

The purpose of this chapter is to describe the existing environment, including conditions and trends, that will be addressed by management alternatives in Chapter 3 and Chapter 4. Descriptions focus on lands administered by the Forest Service or Bureau of Land Management (BLM) in the project area.

Aquatic, riparian, wetland, and upland habitats and their related species of plants and animals function in a connected and integrated manner. However, discussion of these systems is made easier by separating the various components. Accordingly, this chapter is organized by:

Landscape Dynamics Component

- *Physical Setting:* Geology, soils, hydrology
- *Upland Terrestrial Vegetation:* Potential vegetation groups, terrestrial communities, and terrestrial source habitats

Terrestrial Species Component

- *Terrestrial Species:* Plants; animals; source habitats for terrestrial vertebrates; special category species; and hunting, viewing, collecting considerations

Aquatic-Riparian -Hydrologic Component

- *Aquatic-Riparian-Water Quality:* Aquatic habitats, riparian areas and wetlands, water quality, fish and other aquatic species

Social-Economic-Tribal Component

- *Social-Economic:* Social/economic/political systems, population, urban-rural-wildland interface, land ownership and major uses, economic and social characteristics and relationships, overview of employment, communities, attitudes/beliefs/values.
- *Federal Trust Responsibility and Tribal Rights and Interests:* Cultures, changes in uses of and relationships with the land, tribal governments, current federal agency relations, American Indian issues.

Chapter 2 focuses on those portions of the environment that the alternatives (Chapter 3) address and that are administered by the BLM or the Forest Service in the project area. Local conditions may actually be either healthier or more degraded than are described here because those local conditions are not discernible at the broader or regional scale addressed by this EIS.

Information about the landscape, terrestrial, aquatic, and social-economic settings is provided to:

- Focus on broad-scale features, conditions, and trends, in keeping with the refined focus of the project as discussed in Chapters 1 and 3;
- Show specific changes from historical to current times within the project area;
- Describe more fully the statement of needs explained in Chapter 1; and
- Lay the foundation for understanding and evaluating the alternatives discussed in Chapters 3 and 4.

A Summary of Conditions and Trends (from the historical to current period) is provided for each section.

Where appropriate, information is organized by potential vegetation group (PVG) and described by ecological reporting unit (ERU) or Resource Advisory Council/Provincial Advisory Committee (RAC/PAC) area, where data is summarized for those areas. ERUs and RAC/PACs are explained below.

A detailed description of the project area is provided in the *Integrated Scientific Assessment for Ecosystem Management in the Interior Columbia Basin and Portions of the Klamath and Great Basins* (Quigley, Haynes, and Graham 1996, hereinafter referred to as the *Integrated Assessment*) and *An Assessment of Ecosystem Components in the Interior Columbia Basin and Portions of the Klamath and Great Basins* (Quigley and Arbelbide 1997; hereinafter referred to as the *Assessment of Ecosystem Components, or AEC*). In combination, these two documents are referred to as the *Scientific Assessment.*

The *Scientific Assessment* characterizes the entire project area, regardless of ownership, to set a context within which individual BLM or Forest Service administrative units can plan and conduct ecosystem-based management. Findings in the *Scientific Assessment* are best used to understand trends on the overall landscape. In comparison, Chapter 2 of the Supplemental Draft EIS, which is based on the *Scientific Assessment,* focuses on those portions of the environment that the alternatives (Chapter 3) address and that are administered by the BLM or the Forest Service in the project area. These descriptions are limited to the significant *broad-scale* conditions and trends of most concern to the public, the Forest Service, or the BLM. Descriptions of *site-specific* conditions can generally be found in current land use plans available at local Forest Service or BLM offices. Readers should be aware that local conditions may actually be either healthier or more degraded than are described here because those local conditions are not discernible at the broader or regional scale addressed by this EIS.

Changes from Draft EISs

Chapter 2 Overall

Refined Broad-scale Focus
While the organization closely parallels that in the Draft EISs, the content in some places has been changed to reflect the refined focus of the project as described in Chapters 1 and 3, based either on new information from science, comments on the Draft EISs, and/or discussions with tribal and interagency partners. This refined focus addresses a limited number of issues which must be resolved at the basin level. Therefore, some Chapter 2 discussions from the Draft EISs have been dropped if they were determined to be more fine-scale than would be appropriate for the broad-scale focus of this project. All information has been updated and revised as appropriate.

Landscape Dynamics Component
The Physical Setting portion of the Landscape Dynamics Component includes discussion of hydrologic processes and functions, which was located in the Aquatic-Riparian section of the Draft EISs. Water Quality is discussed under Aquatic-Riparian Hydrologic in the Supplement to better link the topic to aquatic habitats.

Terrestrial Species Component
Chapter 2 of the Draft EISs presented information on terrestrial species by potential vegetation group. The Supplemental Draft EIS provides instead a separate Terrestrial Species section, with information on terrestrial vertebrates organized primarily by Terrestrial Family from *Source Habitats for Terrestrial Vertebrates of Focus on the Interior Columbia Basin* (Wisdom et al. in press). Additional information on plants is provided. See the Terrestrial Species section for details.

Aquatic–Riparian Hydrologic Component
The Draft EISs included detailed discussion of ocean-type chinook salmon and Snake River sockeye salmon. The aquatic Science Advisory Group did not include these species in their detailed evaluation because virtually the entire spawning and rearing habitat for these species occurs on non-federal land. Therefore, ocean-type chinook salmon and Snake River sockeye salmon are not discussed in detail in this Supplemental Draft EIS.

Social–Economic–Tribal Component
The Draft EIS sections on Human Uses and American Indians have been combined into one Social–Economic–Tribal Component, to better reflect these closely interrelated issues. The Social–Economic portion has been substantially revised to better display social and economic conditions, trends, and effects relating to counties and communities and incorporate information from *Economic and Social Characteristics of Communities in the Interior Columbia Basin* (ICBEMP1998). Portions of the UCRB Draft EIS (Human Uses Overview) and Eastside Draft EIS (Snapshots in Time) are combined and provided on the pages immediately preceding Chapter 1.

How Information was Gathered and Presented

Hydrologic Unit Codes

For the purposes of analyzing and summarizing much of the information on landforms and on terrestrial and aquatic ecosystems collected for the *Scientific Assessment*, the Science Integration Team identified watersheds and watershed boundaries. The identification system used to describe these watersheds follows the numeric coding system known as Hydrologic Unit Codes (HUCs) used by the U.S. Geological Survey (Figure 2-1 and Table 2-1a).

Boundaries and their numeric codes for larger watersheds ("regions", "subregions", "basins", and "subbasins", respectively coded as 1st- through 4th-field HUCs) were adopted without change from those identified by the U.S. Geological Survey. There are 160 4th-field HUCs in the interior Columbia Basin. Smaller units ("watersheds" and "subwatersheds" or 5th- and 6th-field HUCs) were identified as part of the ICBEMP process. Within the project area there are approximately 7,000 subwatersheds, or 6th- field HUCs, which are approximately 20,000 acres each. These subwatersheds were the basic characterization unit for the *Scientific Assessment* and the basic mapping unit for identifying Ecological Reporting Units. The subwatersheds mapped as part of this project do not necessarily match those that have been previously mapped by administrative units of the Forest Service or BLM.

Ecological Reporting Units

In the Draft EISs and the *Scientific Assesment*, the project area was divided into 13 geographic areas called Ecological Reporting Units (ERUs) to provide a consistent way for each Science Intergration Team staff group to report their findings. The ERUs were developed specifically for consistent reporting purposes, not for analysis or implementation. They correspond to the boundaries of subwatersheds (defined above). The 13 ERUs were identified by a process that integrated human uses and terrestrial and aquatic ecosystem data. They were the basis for reporting information on the following: (1) description of biophysical environments, (2) characterization of ecological processes, (3) discussion of past management activities and their effects, and (4) identification of landscape management opportunities.

Resource Advisory Council/ Provincial Advisory Committee (RAC/PAC) Areas

For the Supplemental Draft EIS, the project area was further described by 12 existing Resource Advisory Council (RAC) areas or Provincial Advisory Committee (PAC) areas, referred to as RAC/PAC areas. Each area has its own advisory council or committee. Resource Advisory Councils (RACs) were established by the BLM to provide a forum for non-federal partners to engage in discussion with BLM managers regarding management of federal lands. Provincial Advisory Committees (PACs) were established by the Forest Service, under the Northwest Forest Plan, to provide a forum for non-federal groups and individu-

Ecosystem Principles

The Science Integration Team brought forward four ecosystem management principles in the *Framework for Ecosystem Management in the Interior Columbia Basin and Portions of the Klamath and Great Basins* (Haynes, Graham, and Quigley 1996). The EIS was developed to be consistent with these principles:

1. Ecosystems are dynamic, evolutionary, and resilient.
2. Ecosystems can be viewed spatially (on the ground) and temporally (through time) hierarchically within organizational levels.
3. Ecosystems have biophysical, economic, and social limits.
4. Ecosystem patterns and processes are not completely predictable.

Figure 2-1. Hydrologic Hierarchy

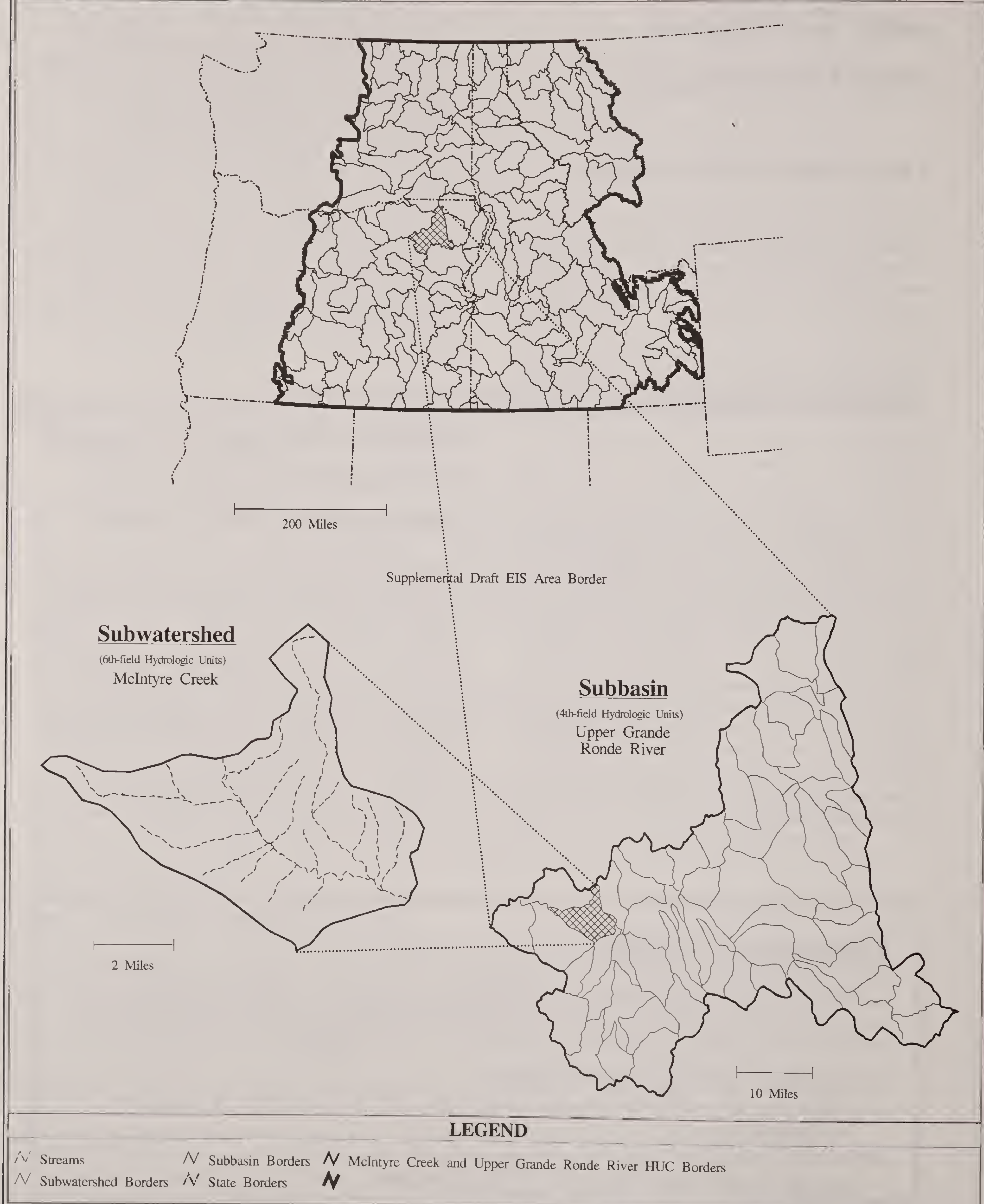


Table 2-1a. Hierarchy of Watersheds.

Hierarchy Team	Hydrologic Unit Code (HUC)[1]	Number in Project Area[2]	Example Watershed	Size of Example (Acres)
Region	1st-field	3	Columbia River	165,760,000[3]
Subregion	2nd-field	10	Lower Snake River	22,400,000
River Basin	3rd-field	16	Salmon River	8,960,000
Subbasin	4th-field	160	Upper Grande Ronde River	1,050,000
Watershed	5th-field	2,356	McIntyre Creek	50,000
Subwatershed	6th-field	6,788	Profile Creek	12,600

[1] 1st-field thru 4th-field HUCs were formally designated by the U.S. Geological Survey. 5th-field and 6th-field HUCs were designated for the project area (Jensen et al. 1997).
[2] Includes all watersheds that are entirely or partly within the project area.
[3] The area of the Columbia River watershed includes the entire basin, including portions outside the project area west of the crest of the Cascade Range and in Canada. Figures rounded to nearest 10,000 acres.

als to advise and make recommendations to federal land managers regarding management of federal lands.

As previously stated, the ERUs were used primarily as *reporting units*. Based on public comment received on the Draft EISs, it was felt that the already established RAC and PAC areas would be more practical as *implementation units*; therefore, they are introduced in this EIS and information is summarized by these areas whenever possible. However, not all information is summarized by RAC/PAC area, and not all socio-economic or ecological processes conform to RAC/PAC boundaries. Where either of these situations occur, descriptions are within the appropriate or available context. The boundaries of RAC/PAC areas and ERUs are similar, but not identical. Both boundaries are shown on Map 2-1; a crosswalk is shown in Table 2-1b.

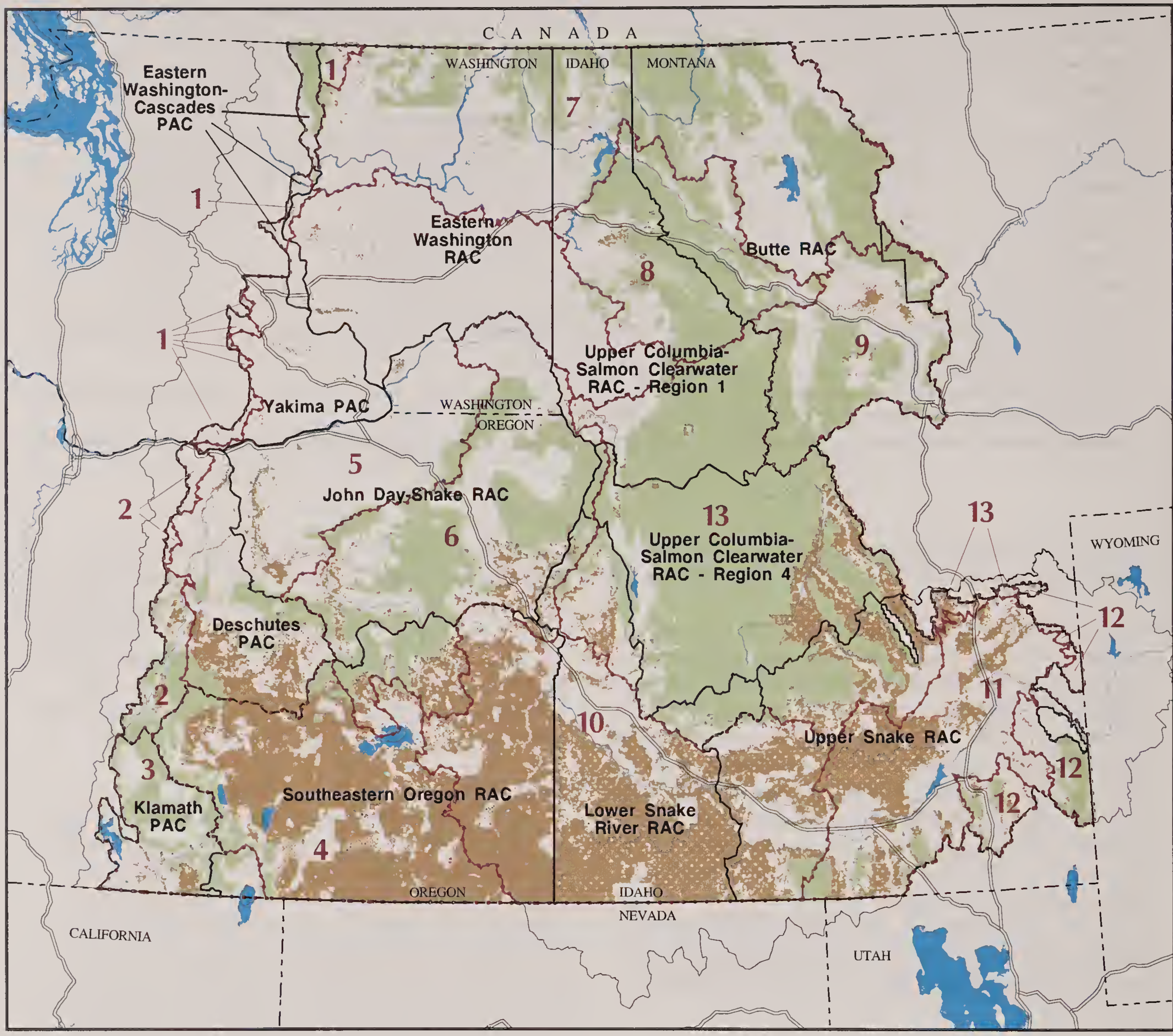
Counties and BEA Regions

A comparison of economic, social, and political systems provides the proper context for agency decisions regarding economic and social objectives. People-oriented policies of the Forest Service and BLM historically have had a local focus, emphasizing the well-being of individuals, user groups, and communities that are economically or socially connected to agency lands. For this EIS, the primary scale of interest is the basin. Information on current conditions and trends is presented at two main levels.

The broadest level at which recent social and economic conditions are discussed is for the interior Columbia River Basin as a whole. A second level of analysis focuses on counties or communities grouped in terms of their perceived character (timber; recreation, tourism and retirement; ranching; mining; and, other) and/or based on their trading area. When using county-level data in this analysis, the region is defined as the 92 counties into which any part of the project area falls, although for some of these counties the land area and economic activity that occur within the basin are minor. Market and non-market economic phenomena are discussed at the national level when necessary to set context. (See Map 2-2.)

To understand socio-economic processes, the Science Team defined two sets of subregions within the basin: one set to examine regional economies, the other to examine the societal value of what might be supplied by BLM- and Forest Service-administered lands in various ecosystems. When discussing the regional economy, they used nine economic regions, modified from a recent publication by the Bureau of Economic Analysis (BEA). The BEA defined functional economic units by identifying economic nodes and the surrounding counties economically related to them. Work commuting patterns are the primary factor used to determine economic regions. The goal is to include, as far as possible, both the place-of-work and place-of-residence of the labor force (see Map 2-24 later in this chapter).

The Supplemental Draft EIS uses RAC/PAC areas as the base level for display of estimated biophysical and socio-economic effects. Some economic and social conditions are also described for counties, and to the extent possible, for communities or groups of communities, to provide some basis for evaluating probable effects of management alternatives at a more local level. However, the broad-scale level of analysis and estimation of effects, as well as data limitations, make it impossible to provide specific effects for each community in this planning process (see Haynes and Horne [1997] and McGinnis and Christensen [1996]).



Map 2-1. RAC/PAC Areas and Ecological Reporting Units

INTERIOR COLUMBIA BASIN ECOSYSTEM MANAGEMENT PROJECT

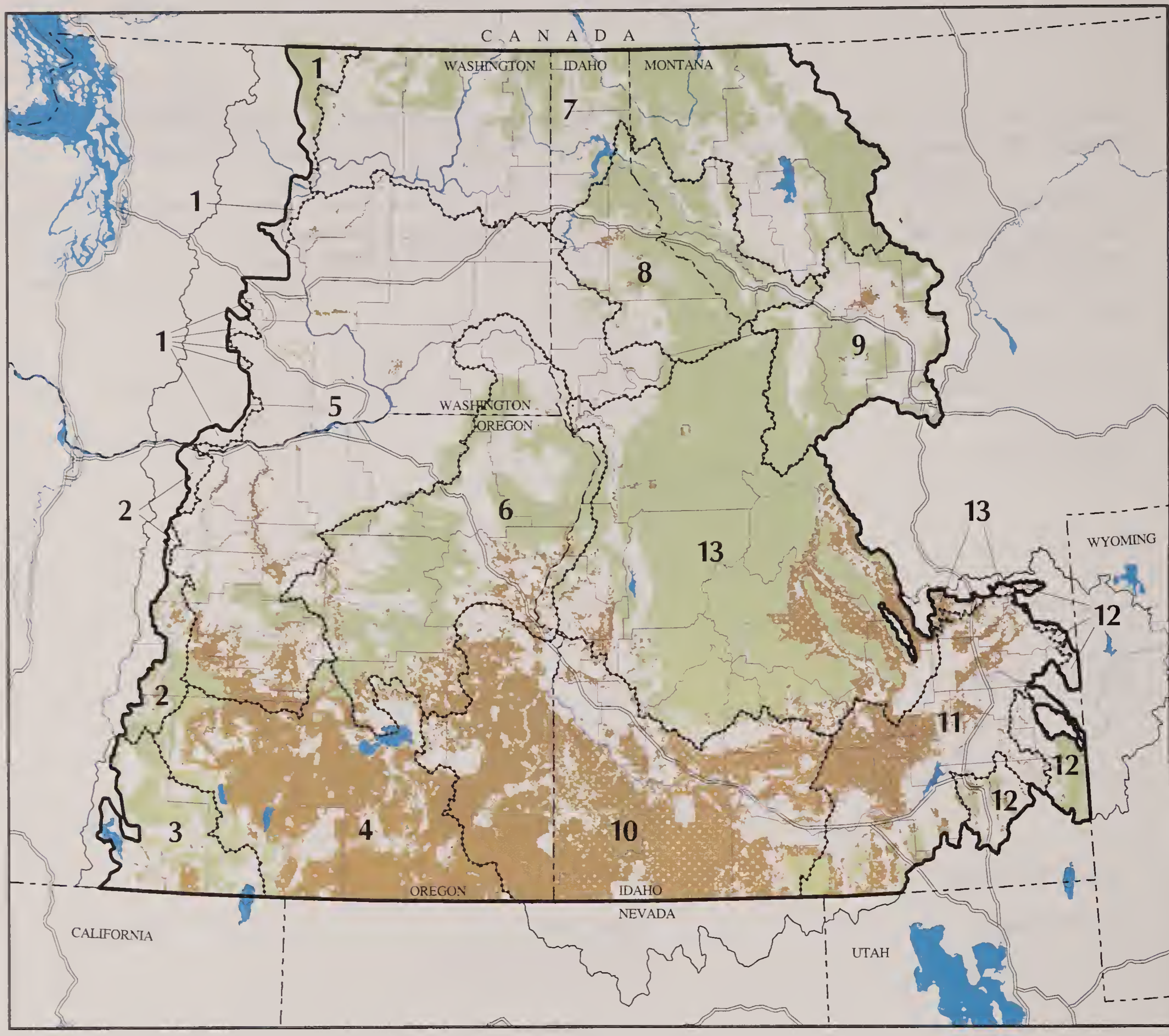
Supplemental Draft EIS Area
2000

- Forest Service-Administered Lands
- BLM-Administered Lands
- Water
- Major Roads
- RAC/PAC Borders
- Ecological Reporting Unit Borders:

1 Northern Cascades
2 Southern Cascades
3 Upper Klamath
4 Northern Great Basin
5 Columbia Plateau
6 Blue Mountains
7 Northern Glaciated Mountains
8 Lower Clark Fork
9 Upper Clark Fork
10 Owyhee Uplands
11 Upper Snake
12 Snake Headwaters
13 Central Idaho Mountains

Table 2-1b. Crosswalk Between the Ecological Reporting Units and the Resource Advisory Council/Provincial Advisory Committee Areas.

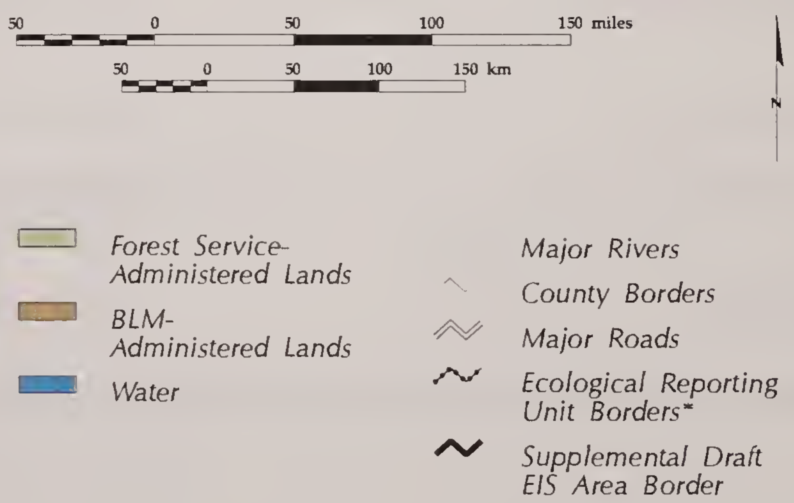
Ecological Reporting Units (ERUs)	Resource Advisory Council/Provincial Advisory Committee (RAC/PAC) Areas
Blue Mountains	John Day-Snake RAC Southeastern Oregon RAC
Central Idaho Mountains	Upper Columbia/ Salmon-Clearwater RAC Regions 1 and 4 Lower Snake River RAC
Columbia Plateau	Eastern Washington RAC Yakima PAC Deschutes PAC Upper Columbia/ Salmon-Clearwater RAC Region 1 John Day-Snake RAC
Lower Clark Fork	Butte RAC Upper Columbia/ Salmon-Clearwater RAC Region 1
Northern Cascades	Yakima PAC Eastern Washington- Cascades PAC Eastern Washington RAC
Northern Glaciated Mountains	Butte RAC Upper Columbia/ Salmon-Clearwater RAC Region 1 Eastern Washington RAC
Northern Great Basin	Southeastern Oregon RAC
Owyhee Uplands	Upper Snake RAC Lower Snake River RAC Southeastern Oregon RAC
Snake Headwaters	Upper Snake RAC
Southern Cascades	Yakima PAC Deschutes PAC
Upper Clark Fork	Butte RAC
Upper Klamath	Southeastern Oregon RAC Klamath PAC
Upper Snake	Upper Snake RAC



Map 2-2. Ecological Reporting Units and Counties

INTERIOR COLUMBIA BASIN ECOSYSTEM MANAGEMENT PROJECT

Supplemental Draft EIS Area
2000



*Numbers indicate ecological reporting units. See Map 2-1 for names.

Historical Range of Variability

The historical period of pre-European settlement was selected for this EIS only as a reference point from which to compare current conditions.

Throughout this chapter, reference is made to "historical conditions" or the "historical range of variability." "Historical" in this EIS is intended to represent ecological conditions and processes that are likely to have occurred prior to settlement of the project area by people of European descent (approximately the mid 1800s). Historical conditions and processes are portrayed in this EIS for a number of variables such as forest and range vegetation types, compositions, and structures; fish and wildlife habitats and populations; and fire regimes. These historical conditions would have varied over time within an estimated range. Historical conditions referenced in this EIS generally represent some point within the historical range of variability (HRV) (Figure 2-2).

The historical period of pre-European settlement was selected for this EIS **only as a reference point**, to establish a baseline set of ecological conditions for which sufficient scientific or historical information is available to enable comparison to current conditions.

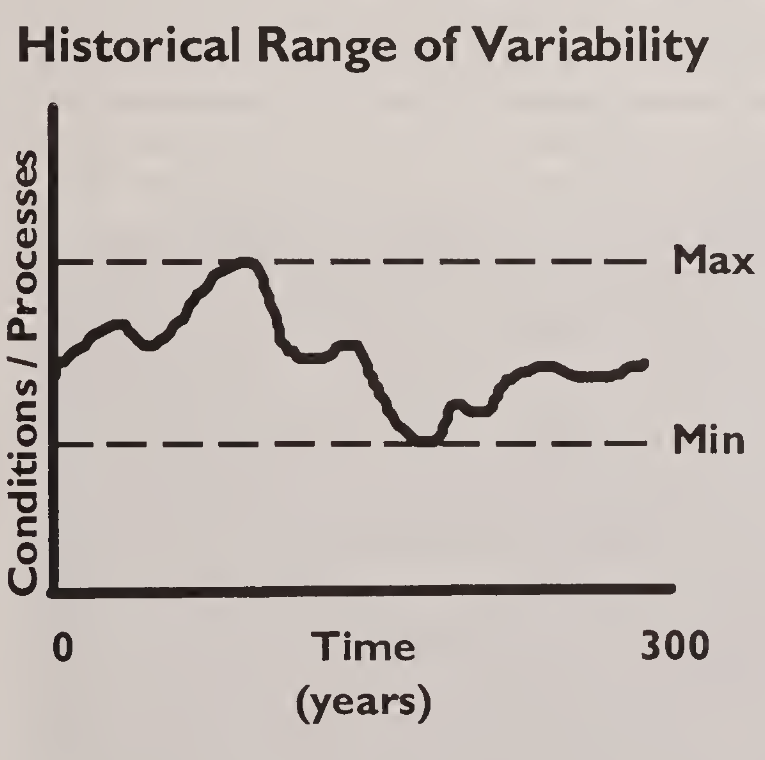


Figure 2-2. Historical Range of Variability.
Conditions naturally vary over time, generally within a certain range. Scientists have estimated what that range may have been in the past. Conditions higher than the estimated maximum or lower than the estimated minimum would be considered to be outside the 'historical range of variability' and may be an indication of a loss of ecological integrity and ecosystem health.

Such a comparison is valuable to understand how ecological processes and functions operated with human uses, but prior to high human populations and contemporary technology. This can provide clues and blueprints for designing management strategies that maintain the ecological integrity of those processes under future management strategies. It is recognized that in many cases, it is neither desired nor feasible to return to actual historical conditions. For example, historically there were no paved roads or buildings in the project area; obviously it is neither feasible nor desirable to return to that condition.

Ecological Integrity and Ecosystem Health

One of the underlying needs for preparing this EIS is for "restoration and maintenance of long-term ecosystem health and ecological integrity on Forest Service- and BLM-administered lands" (see Chapter 1). Integrity generally means the quality or state of wholeness or being complete and unimpaired. The Science Team used the term "ecological integrity" as a measure of the presence of physical and biological processes, patterns, and functions. The concept of ecological integrity helps to answer many questions, including:

1. Where are the areas of high or low ecological integrity across the project area?
2. Where are the opportunities to improve integrity?
3. What risks to integrity exist from management actions?

Because there are no direct measures of integrity, "proxies" or substitutes were selected to represent the broad array of functions, processes, and conditions. For example, the proportion of the area where fire severity and frequency changed between historical and current periods was used as one of the proxies to represent such elements as consistency of tree stocking levels with long-term disturbances and

Broad, Mid, and Fine Scale

Ecological processes and structures can be viewed at multiple scales, depending on the feature or process to be observed or the outcome that is desired. Landscape ecology often uses terms like broad, mid, and fine temporal (time) and spatial (geographic) scale. The *Scientific Assessment* and interior Columbia Basin EISs also use these terms. Temporal and spatial scale are often linked. In the EIS, short term for the broad scale is considered to be 10 years and long term is considered to be 100 years (unless otherwise specified). In the *Scientific Assessment*, the dynamics of the historical range of variability (HRV) were assessed over a 400-year time period to learn how ecosystems changed through time with succession and disturbance. This was helpful in determining management direction to modify ecosystems into the future.

The three levels of geographic scale (broad, mid, and fine) were analyzed in the *Scientific Assessment* and addressed in the EIS:

Broad scale - a large, regional area, such as a river basin and typically a multi-state area. A broad-scale analysis can identify dominant characteristics and trends across a large area (such as the interior Columbia River basin). Much of the analysis of the interior Columbia River basin was at a broad scale where 1 inch on a map ranged from 1.5 to 31.5 miles on the ground (1:100,000 to 1:2,000,000). These are maps in which the size of a pixel (the smallest polygon mapped) is 1 square kilometer (250 acres) or larger. At this scale, the distance from Seattle to Spokane would be obvious, but streets in Spokane would be too small to see (similar to a state highway map).

Mid scale - a subregional area, such as a group of contiguous subbasins. The *Scientific Assessment* addressed many aspects of BLM- and Forest Service-administered lands at the mid scale (where 1 inch on a map represented 0.4 to 1.5 miles [1:24,000 to 1:100,000] on the ground). For example, vegetation types, insect and disease susceptibility, riparian conditions, potential wildfire risk, and roads were mapped at this mid scale for 334 subwatersheds (a statistical sample size). This information was then correlated with broad-scale data and extrapolated across the project area. The pixel size of a mid-scale map is 4 hectares (10 acres) or larger. At this scale, the relation between Division Street in Spokane and other streets in the same city would be visible, but the distance from Spokane to Seattle (the broad-scale perspective) would be lost (similar to a city map).

Fine scale - a single landscape, such as a watershed or subwatershed. The *Scientific Assessment* addressed many aspects of BLM- and Forest Service-administered lands at the fine scale (where 1 inch on a map represents 0.4 miles [1:24,000] or less). For example, variations in forest snags and fuels was assessed through analysis of plot data, while specific fisheries stream data was used to assess trends of fish habitat and populations. At this scale, the location of a particular desk in a particular building would be visible, but the location of the building in a city or the city in a state would be lost (similar to a blueprint or a house plan).

As scale moves from coarse or broad to fine, the amount of visible detail increases but the relationships among larger components become less visible. While fine-scale maps and data might appear to be most desirable, there are tradeoffs. Broad-scale maps and data help to understand broad-scale relations. Fine-scale data are difficult and expensive to acquire and the amount of detail may mask larger relations or trends.

In reality, scales are continuous, much like looking through a camera lens while zooming in and out to focus on the desired subject or composition of the photo. Humans use pictures or maps at different scales to help achieve different objectives. For example, a state highway map would be used to find a route across the state, while a city map would be used to find a hotel or a park.

Attempting to focus on only one scale can cause errors in decisions, much like what could happen if a city map is used to find a route across a state. In general the better the next coarser scale is understood, the more context is available to assure goals are met; and the better the next finer scale is understood, the better the understanding of the function of ecosystem components. For example, at a finer scale, the function of snags as habitat can be discerned, while the areas where snag levels are decreasing can be determined at a larger scale; both scales are important. If the broad-scale direction from this EIS says to increase snag levels where their numbers are below the historical range of variability, then the best options for restoring the desired pattern of snags could be determined through mid-scale planning (such as a land use plan), and the specific numbers, species, sizes, and recruitment patterns of snags could be determined through finer scale planning (such as an environmental assessment).

the effect of wildfire on the composition and patterns of forest types. Proxies such as these were used to estimate current conditions and project trends in integrity into the future.

Ecosystem "health" encompasses both ecological integrity and what people want to do with the land.

Ecological integrity is difficult to measure directly for several reasons. First, it is unknown exactly what is in any particular ecosystem, because of the size, complexity, and ambiguous nature of most of its parts and processes. Second, the structure, function, and composition of ecosystems are always changing. Third, ecosystem changes are only partially predictable; they respond to a combination of internal processes and outside influences. And finally, the boundaries people put on ecosystems are artificial lines, making it hard to know when an entire system or a part of one or more systems are being studied.

Therefore, integrity was estimated in a relative sense. Where forest, rangeland, and aquatic system processes and functions were present and operating best in the project area, integrity was rated higher than areas where these functions and processes were not operating. These estimates represented such elements as water cycling, energy flow, nutrient cycling, and maintenance of viable populations of plants and animals.

In general, for the purposes of the Interior Columbia Basin Ecosystem Management Project, aquatic and terrestrial systems with "high integrity" were defined as those that consist of a mosaic of plant and animal communities, and have well connected, high quality habitats that support a diverse assemblage of native and desired non-native species that adapt to a variable environment. Measures were developed by the Science Integration Team using direct and indirect variables to indicate how much various elements have departed from historical conditions. For the purposes of this analysis, "high departure" signifies that an area is significantly different than the condition expected for its biophysical environment, and roughly indicates "low integrity." In measuring integrity, the Science Team looked primarily at landscape features and fish communities, because they encompass most of the significant planning issues (see Chapter 1). The emphasis on landscape features and fish also provides a geographically explicit, ecologically driven context for discussing management alternatives.

The integrity of ecosystems encompasses both biophysical and social components because any discussion of ecosystems is also inherently a discussion about the way humans value and use the land. The concept of ecological integrity, as described above, is part of the broader concept of ecosystem health used in the EIS. The EIS Team used the term "health" to refer to the capacity of forest, rangeland, and aquatic ecosystems to persist and perform as expected or desired in a particular area. Varying degrees of "wholeness" or integrity may be needed to enable a particular place to be used in the manner desired by society both now and in the future. Some uses will demand different mixes of fire regimes, water cycles, and energy flow resulting in differences in productivity, resiliency, and renewability. The mix of these elements of "integrity" that would allow achievement of a particular management objective in a particular place will define what is "healthy" for that area.

The integrity of ecosystems encompasses both biophysical and social elements, because any discussion of ecosystems is also a discussion of the way humans value and use the land.

For example, in some areas, such as near developed recreation sites or areas with scattered homes, restricting the presence of fire as a process may be important to achieving the broad goals for an area. The result may mean lower ecological integrity than if the fire regimes were allowed to operate fully, but might be judged as

Ecological Processes and Functions

The terms "ecological processes" and "ecological functions" in general refer to the flow and cycling of energy, materials, and organisms in an ecosystem. The nitrogen, carbon, and hydrologic cycles, and energy flow in terrestrial systems are among the ecological processes discussed in other sections of this chapter. Following are some additional functions and processes that are important to ecosystem health

- **Water capture.** Sites are able to effectively capture water when they maintain high infiltration rates and a high capacity for surface capture and storage of water.
- **Water storage.** Water is stored well when soil is stable and able to retain moisture; and when soil organic matter, well dispersed litter, and plant canopies that reduce evaporation losses from the soil are maintained.
- **Water cycling.** Water is cycled more effectively when it is released from a site in such a way that (1) low amounts of sediment are transported in runoff, (2) there is sufficient subsurface flow of water, and (3) plants and animals are able to use water for physiological functions.
- **Nutrient and energy cycling.** In healthy ecosystems, nutrients cycle and energy flows through a system in a pattern that is appropriate for the geoclimatic setting.
- **Energy capture (photosynthesis).** Plants are able to store resources necessary for drought survival, overwintering, and new growth initiation. They retain canopy cover, litter, and root systems sufficient to protect them from death or loss of vigor during stress periods.
- **Adaptation.** Plants and animals have evolved and adapted to conditions on the landscape. Healthy ecosystems have sufficient food, cover, and other habitat attributes to maintain sufficient populations for reproduction, genetic interactions, and long-term survival.

healthy from an ecosystem perspective because it is meeting the expectations of society. Another example might be managing to restrict riparian flooding, which from an ecological frame of reference would reflect lower integrity than if the flooding were to be present, yet this area might contribute to the overall ecosystem health because it is favorably contributing to society's goals.

Ecosystem health includes not only how "intact" the ecological processes and functions need to be compared to their capabilities to accomplish current and future management objectives, but it also includes measures of social and economic resiliency, management philosophies and goals, and other human factors.

Positive Ecological Trends

The nature of the Interior Columbia Basin Ecosystem Management Project has been to focus on what is going wrong with ecosystems, then to determine what changes to management activities are necessary to improve ecological conditions. Much of the discussion in Chapter 2 emphasizes these needed changes.

Although some ecosystems have declined in health, many ecological conditions and trends have improved in the past two decades. Some areas where improvement has been achieved over the past 10 to 20 years on Forest Service- or BLM-administered lands are as follows:

- **Soil productivity**—Management practices in use today reflect improved understanding of the sensitivity of soils to various treatments, especially at the fine scale.
- **Road construction and management**—Management practices in use today reflect improved understanding of negative effects of roads. New road construction and maintenance of permanent roads occur with greater understanding of drainage, erosion potential, fish passage concerns, slumpage problems, and other hazards. Much remains to address in the future, especially with secondary and closed roads.

Although the condition of some ecosystems has declined, many ecological conditions and trends have improved in the past two decades.

- **Range management and range conditions**—The current condition of rangelands appears to be the best it has been since the turn of the century; however, this assessment is not agreed upon by all (National Research Council 1994). The declining condition of riparian areas has, for the most part, been slowed or stopped, and managers are acquiring a better understanding of how to alleviate negative effects of management practices on riparian areas. The BLM and Forest Service are placing a heavy emphasis on proper management of riparian areas in land use plans and on the ground.
- **High-profile listed species**—Many of these species are protected. The grizzly bear, bald eagle, and some others (see Appendix 6) have recovery plans that are in place and are being implemented. Attention has expanded to also include other species that traditionally have generated less public appeal.
- **Landscape approach recognition**—Overall, land managers within the project area have recognized the need for a landscape approach to management of resources. A landscape approach is a broader, more integrated look at resource management than has been traditionally done in the past. On-the-ground managers appear ready and willing to accept the change, and in fact many managers are already using this approach to resource management.
- **Prescribed fire techniques**—Techniques available for prescribed fire within the project area have improved. A variety of conditions can now be achieved from the application of prescribed fire using different treatments.
- **Forest management approaches**—The past 10 years have seen substantial change in the treatments applied to forested areas, both in harvest techniques and silvicultural treatments. Managers have a wider array of options with more benign effects to select as treatments.
- **Recognition of exotic species and their influence**—The relatively recent and rapid expansion of exotic species and their impact on ecosystems are receiving more attention by resource managers, who recognize that preventing the spread and reducing the extent of exotics is necessary. Scientists are testing and developing combinations of control methods that are promising for control of exotic plant species.
- **Interaction with a wide array of the public**—Recent trends have been for managers to have more open discussions earlier in planning processes with a wider, more varied group of people, organizations, and agencies.

Landscape Dynamics Component : Physical Setting

Key Terms Used in This Section

Air Pollutants — Any substance in air that could, if in high enough concentration, harm humans, other animals, vegetation, or material. Air pollutants may include almost any natural or artificial matter capable of being airborne, in the form of solid particles, liquid droplets, gases, or a combination of these.

Air Quality — The composition of air with respect to quantities of pollution therein; used most frequently in connection with "standards" of maximum acceptable pollutant concentrations.

Coarse woody debris (CWD) — Woody material derived from tree limbs, boles, and roots in various stages of decay, larger than 3 inches (7.5 cm) in diameter.

Geologic processes — The actions or events that shape and control the distribution of materials, their states, and their morphology, within the interior and on the surface of the earth. Examples of geologic processes include: volcanism, glaciation, streamflow, metamorphism (partial melting of rocks), and landsliding.

Geomorphology — The geologic study of the shape and evolution of the earth's landforms.

Headwaters — Beginning of a watershed; unbranched tributaries of a stream.

Hydrologic — Refers to the properties, distribution, and effects of water. "Hydrology" refers to the broad science of the waters of the earth—their occurrence, circulation, distribution, chemical and physical properties, and their reaction with the environment.

Physiography — Pertaining to the study of the formation and evolution of landforms.

Sediment — Solid materials, both mineral and organic, in suspension or transported by water, gravity, ice, or air; may be moved and deposited away from their original position and eventually will settle to the bottom.

Soil organic matter — A variety of compounds derived from weathering and decomposition of plant residue. Organic matter within the litter layer or surface soil horizon is an important nutrient reservoir for maintaining soil productivity.

Soil productivity — The capacity of the soil to support plant growth, due to the physical and chemical characteristics of the soil including depth, temperature, water-holding capacity, and mineral, nutrient, and organic matter content.

Tectonic — Relating to, causing, or resulting from structural deformation of the earth's crust. An earthquake is an example of a type of tectonic process.

Watershed — 1) The region draining into a river, river system, or body of water. 2) In this EIS, the term watershed also refers specifically to a drainage area of approximately 50,000 to 100,000 acres, which is equivalent to a 5th-field Hydrologic Unit Code (HUC).

Summary of Conditions and Trends

Soils and Soil Productivity

- Soil productivity across the project area is generally stable to declining. Generally, greater declines in soil productivity are associated with greater intensities of vegetation management, roading, and grazing.
- Soil organic matter and coarse wood (woody material larger than three inches) have been lost or have decreased in many areas as a result of displacement and removal of soils and removal of whole trees and branches due to management activities.
- In wilderness, roadless, and other areas, high levels of coarse wood and organic matter have accumulated because of fire suppression and mortality resulting from insect and disease outbreaks.
- Soil material has been lost through direct displacement of soils and through surface and mass erosion. Erosion can result from changed water runoff patterns caused by increased soil exposure (such as from loss of biological crusts), soil compaction, and concentration of water from roads.
- Changes in the physical properties of soils have occurred in conjunction with activities that increase bulk density through compaction. These changes have largely resulted in impaired soil process and function, such as decreased porosity and infiltration and increased surface erosion.
- Sustainability of soil ecosystem function and process is at risk in areas where redistribution of nutrients has resulted from changes in vegetation composition and pattern, removal of larger wood, and risk of uncharacteristic fire.
- Floodplain and riparian area soils have reduced ability to store and regulate chemicals and water, in areas where riparian vegetation has been reduced or removed or where soil loss associated with roading in riparian areas has occurred. In these areas, water quantity may be reduced during low flows, and water quality may have less buffer from pollution.

Hydrology and Watershed Processes

- Management activities throughout watersheds in the project area have affected the processes of sedimentation and erosion and the production and distribution of organic material, thus affecting hydrologic conditions. On federally administered lands the most pronounced changes to watersheds are due to water diversions and impoundments, road construction, vegetation alteration (including silvicultural practices, fire exclusion, and forage production), and excessive livestock grazing pressure.
- Stream flow regimes have been locally affected by dams, diversions, and groundwater withdrawal. More subtle but widespread changes to natural stream flows on federally administered lands have probably been caused by road construction and changes in vegetation due to silvicultural practices and excessive livestock grazing pressure.
- The frequency and extent of seasonal floodplain and wetland flooding have been altered by changes in flow regime due to dams, diversions, and groundwater withdrawal, and by changes in channel geometry due to sedimentation, erosion, and channelization resulting from installment of transportation improvements such as roads and railroads.
- Banks and beds of streams, rivers, and lakes have been altered by bank and shore structures, including urban development, transportation improvements, instream mining activities, flood-control works, and alteration of riparian areas. In general, the changes have been greatest for the larger streams, rivers, and lakes.

Air Quality

- The current condition of air quality in the project area is considered good, relative to other areas of the country.
- Wildfires significantly affect the air resource. Current wildfires produce higher levels of smoke emissions than historically, because fuel available to be consumed by wildfire has increased.
- Within the project area, the current trend in prescribed fire use is expected to result in an increase of smoke emissions.

Introduction to Physical Setting

The template for current ecological conditions is the culmination of millions of years of geological, climatological, and ecological processes. This evolutionary history defines the capabilities of the naturally occurring land systems and provides a framework for limitations on how humans can use the varied terrains and resources of the project area. The material presented here focuses on those geologic, soil and hydrologic, climatological, and air quality issues that are relevant for ecosystem management at the broad scale. Much of the information in this section is derived from the Biophysical (Jensen et al. 1997), Landscape Dynamics (Hann, Jones, Karl, et al. 1997), and Aquatics (Lee et al. 1997) chapters of the *Assessment of Ecosystem Components* (Quigley and Arbelbide 1997); reports of the *Eastside Forest Ecosystem Health Assessment* (Everett et al. 1994); and additional sources as cited.

Geology and Physiography

Plate tectonics, volcanism, glaciation, weathering, erosion, and sedimentation processes over the past 1.5 billion years have resulted in the present mountain ranges, river courses, and watershed divides that characterize the project area.

These geologic and physiographic attributes exert considerable influence over climate, hydrology, and drainage pattern development. Surface topography and soils at the subwatershed scale were largely formed during the Pleistocene ice ages (1.6 million years ago). The physiography of individual channels and hillslopes is controlled primarily by recent (past 10,000 years) geomorphic processes and disturbances, such as floods, landslides, and volcanoes. The diversity of geologic environments, along with active tectonic, volcanic, and glacial processes, has been a controlling influence in the evolution and distribution of ecological systems, including patterns of human development and use.

The physiographic environment also dictates ecological potential and management options. For example, glaciated terrain commonly consists of steep slopes that are covered with highly erodible soils and glacial sediments; areas near volcanoes commonly have thick, ash-rich soils that are highly productive but are also susceptible to compaction.

Erosion, sediment transport, and deposition are the geologic processes most relevant in day-to-day management of ecosystems in the project area. Moreover, these processes have been significantly affected by human activities.

Soils and Soil Productivity

Background: Soil Processes, Functions, and Patterns

Much of the following material is summarized from the Biophysical chapter (Jensen et al. 1997) of the *Assessment of Ecosystem Components* (Quigley and Arbelbide 1997), Harvey et al. (1994), and Henjum et al. (1994).

Critical soil processes—such as nutrient cycling, infiltration, and percolation—occur in the upper few inches or feet of soil. Disruption of soils can lead to long-term changes in ecological conditions.

Soils form an ecologically rich and active zone at the interface between geologic materials and the atmosphere. The soil that occurs at a particular site depends on the geologic parent material, climate, relief, and organisms occurring at that site, and on the amount of time that has been available for these soil-forming factors to interact. Most soils in the project area are young and thin, and critical soil processes—such as nutrient cycling, infiltration, and percolation—occur in the upper few inches or feet. Soil-forming and soil-recovery processes can be slow; therefore, disruption of soils can lead to long-term changes in ecological conditions, including biological and hydrologic processes.

Soil regulates the cycling and availability of plant nutrients through the storage and movement of water and energy within the soil profile (Page-Dumroese

1991; Harvey et al. 1987 in Jensen et al. 1997). Soil anchors vegetation and contains mineral nutrients and water that provide the biological productivity, site stability, and ecosystem resiliency required for plant growth. Soils also contain a vast variety of microorganisms that promote decomposition of organic material, such as leaves, twigs, and large wood. This decomposition process is a critical link in the nutrient cycling process, especially for plant nutrients such as carbon, nitrogen, potassium, phosphorous, and sulfur (see Figures 2-3 and 2-4). The diverse geology and climate of the project area, in conjunction with natural and human disturbance, have resulted in a spatially complex pattern of soils that differ in appearance, function, and response to management activities.

Soil Horizons

Most soils in the ICBEMP project area have formed since the last ice age and are composed of several horizons, or layers. At the surface, there is commonly a thin (generally less than two inches) and sometimes discontinuous cover of decaying organic matter, such as leaves and twigs. Under this cover of litter and duff is a layer (less than a few inches) of dark, highly decomposed organic matter (humus) which covers a mineral layer of up to several feet thick. This mineral layer may contain organic matter, clay minerals, calcium carbonate, and other salts that are transported down the soil column by percolation or burrowing activities. These horizons have differing capacities for supplying nutrients and holding water. Because the highest concentration of nutrients and biota are in the uppermost soil horizons, incremental removals of surface soil (such as by soil erosion) are more damaging than removal of subsoils (Swanson et al. 1989 as cited in Jensen et al. 1997).

In general, forested environments have thicker and more continuous organic matter layers consisting of litter and duff material above the mineral soil compared to rangeland soil horizons. The thickness and amount of organic material varies considerably depending on local vegetation characteristics, climate, relief, and disturbance history (including human uses and fire). These soil horizons together cover weathered and unweathered parent materials, such as bedrock or old stream gravel. Volcanic material is a major component of many soils.

Physical Properties

Physical properties of soils, such as bulk density (dry weight per unit volume), porosity, texture, hydrologic conductivity, soil depth, and mineral content, are all factors controlling hydrologic response, water-holding capacity, and surface stability. Soil water-holding capacity is a critical factor in the project area where growing season precipitation is low. Soils with high organic matter contents generally have high porosities and high water-storage capacities but are susceptible to compaction.

The physical properties of soils can be altered by disturbances such as erosion and compaction. Soil compaction results from concentrated activity, including use of heavy equipment, vehicles, pedestrian activity, and excessive livestock grazing pressure. Where soils are compacted, porosity, permeability, and hydrologic conductivity are reduced, resulting in altered runoff patterns and increased surface erosion. Natural recovery of surface compaction can take 50 to 80 years, depending on the soil type, degree of compaction, frequency of freeze-thaw cycles, and input of organic matter. Recovery of compacted subsoils often requires up to 200 years.

Biological Properties

Soil biological properties also affect productivity. Soil is a reservoir of fungal spores and other organisms important for decomposition and nutrient cycling. These organisms are far more numerous than above-ground plants and animals (Molina and Amaranthus 1990), and their interactions profoundly affect forest site productivity through assimilation of nutrients, protection against disease organisms, maintenance of soil structure, and buffering against moisture stress (Amaranthus and Trappe 1993). Soil moisture and temperature strongly influence forest type, distribution, and soil productivity. Erosion or removal of soil surface layers, where most microorganisms reside and where most of the critical nutrient cycling processes occur, can significantly affect productivity for several decades.

Organic Matter

Organic matter, both above and below ground, is an important component for maintaining soil productivity. Organic matter is important for soil water retention, cation exchange, nutrient cycling, and erosion control (Page-Dumroese et al. 1991). In general, the higher the total soil organic matter, the higher the site productivity. Throughout most of the project area, decomposition of organic matter is often slow, leading to accumulations of surface organic matter. Reductions in soil productivity through the loss of organic matter can be caused by erosion of surface soils, damaging fires, and over-utilization. Management

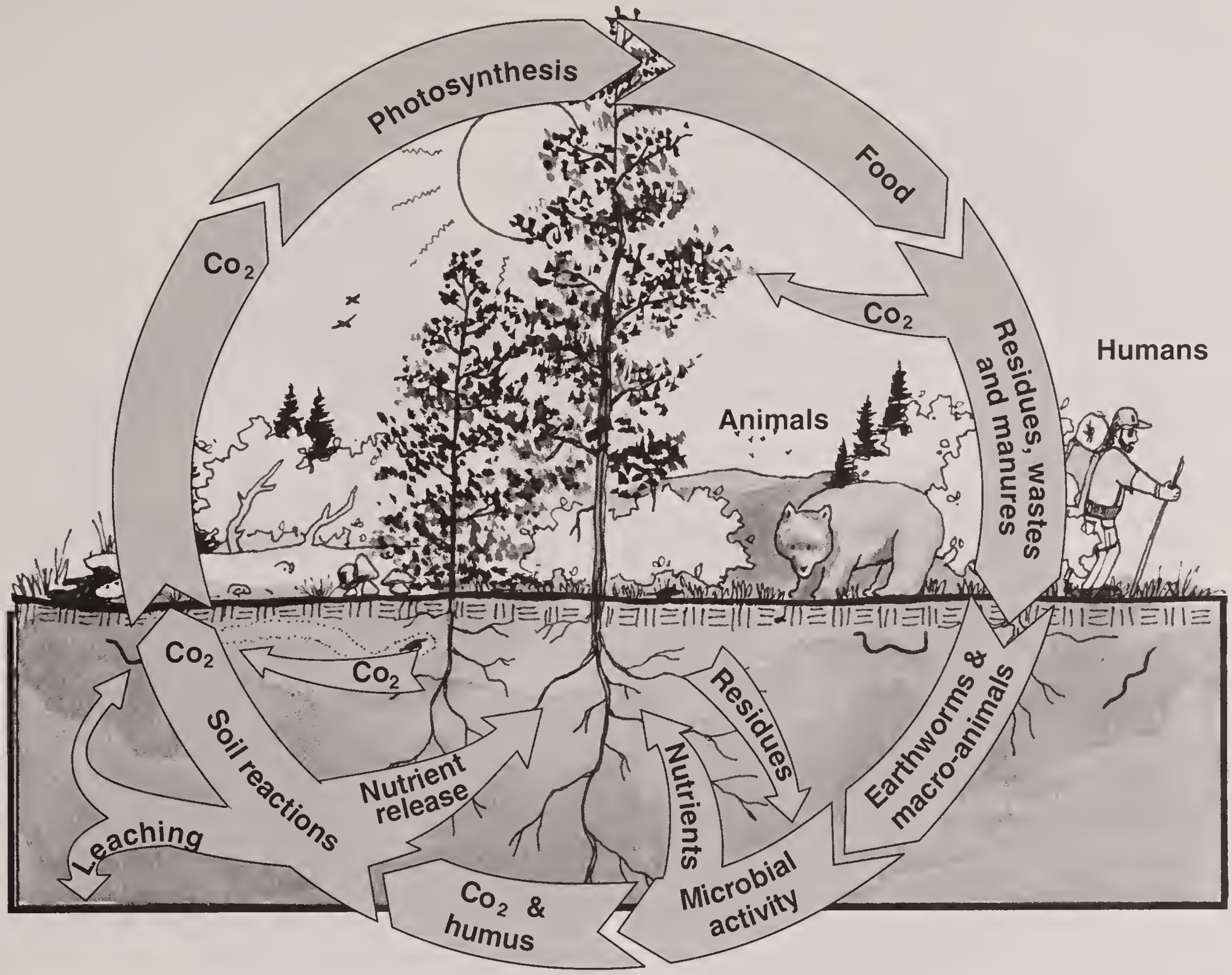


Figure 2-3. Carbon Cycle

Carbon is the key building block in all living cells. It is captured primarily through photosynthesis and stored in the form of plant tissues: needles, leaves, stems, twigs, branches, bark, roots, and wood fiber. Carbon also is diverted below ground to support soil organisms and processes. Carbon is recycled through several processes including respiration of plants and animals, fire, and decomposition by bacteria and fungi. The decomposition process is a critical link in the nutrient cycling process.

More carbon is now being accumulated and stored in the project area in denser stands of shade-tolerant, non-fire-adapted species. Insect and disease disturbance has increased and has begun to play a larger role in carbon recycling. As tree mortality increases, more carbon and nutrients are tied up in standing and downed dead woody material and in deep organic layers on the ground. Soil properties and soil-vegetation relationships also have been affected since many beneficial soil organisms depend on living trees to fuel their activities.

Changes to the carbon cycle can also affect other nutrient cycles such as the nitrogen cycle (see Figure 2-4) and can set the stage for widespread extreme wildfire events that further jeopardize many other ecosystem components and functions.

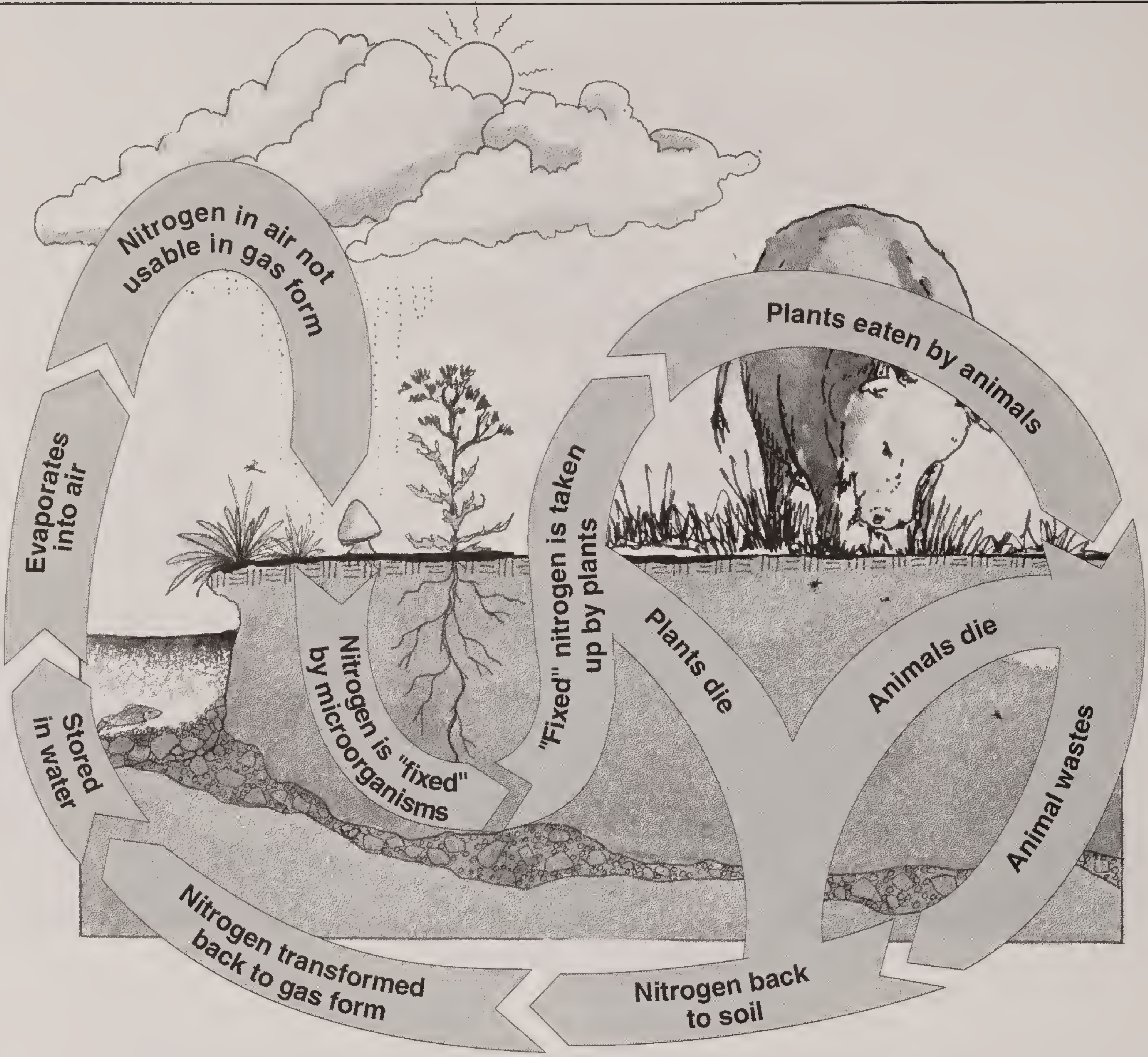


Figure 2-4. Nitrogen Cycle.

Nutrients such as nitrogen are essential for life. Nitrogen is circulated continually among plants, animals, and microorganisms. The amount of nitrogen available and the rate at which it cycles are important to ecosystem health.

Nitrogen in the air can't be used directly by plants and animals; it must be captured and transformed (or "fixed") by specific bacteria or algae into a usable form. Nitrogen-fixing organisms that live on the roots of certain plants change nitrogen gas into forms that can be used in biological processes. When plants and animals die, their bodies are decomposed by other microorganisms to return nitrogen to the air. The decomposition process is a critical link in the nutrient cycling process.

A close, interdependent relationship exists between nitrogen and carbon. The proportions of each element play an important role in regulating the decomposition rate of organic matter and in controlling the rate at which nitrogen and other nutrients are cycled. Factors that affect the nitrogen cycle will also have effects on the functioning of the carbon cycle (see Figure 2-3).

Soil erosion is one of the conditions in the project area that can contribute to reduction or loss of usable nitrogen, by reducing the total organic matter and thus the potential total nitrogen content of the soil. Another condition is the conversion of sites to monocultures of shallow-rooted (often exotic) species, which affects the depth to which plant roots can deposit nitrogen in the soil.

activities, especially those resulting in compaction from equipment or livestock use, can also lead to decreased soil productivity by reducing the availability of organic matter.

Fire

Accumulated litter and woody debris are potential fuel for wildfire, which is an important factor controlling soil conditions in forestlands and rangelands of the project area, especially in drier environments where fire frequency is high (Harvey et al. 1994). The combined processes of biological decomposition and fire regulate nutrient availability and cycling.

Fire can substantially change surface soil characteristics and rates and can influence patterns of vegetation on the landscape.

Fire can substantially change surface soil characteristics and erosion rates and can influence patterns of vegetation on the landscape. Fire can have consequences on soil productivity by consuming organic matter and vegetation. Nutrients, such as nitrogen, can be evaporated by fire, resulting in an immediate loss of soil productivity as well as limiting future inputs of nutrients. However, nutrients such as carbon are also made available by fire, especially by converting large woody debris into smaller, more readily decomposed material (Debano 1990). Forests in the inland West, including the project area, depend on a combination of biological and fire-decomposition processes to regulate nutrient availability and cycling (Harvey 1994).

Fire can also affect soil productivity by creating bare soil or hydrophobic (water-repelling) conditions that alter infiltration, runoff, and erosion processes. In general, the more soil heating that occurs, the greater the potential for water repellence. Dry, coarse-textured soils are most susceptible to becoming water-repellent, especially after high intensity, high severity fires.

Current Conditions and Trends: Soils and Soil Productivity

Overall, soil productivity across the interior Columbia Basin is stable or decreasing. Soil conditions are generally stable in wilderness areas, but in other locations soils are at varying levels of decreasing productivity depending on soil types and intensity of management. Determining the exact status of soil condition for any given area is difficult because of the lack of inventory and monitoring data. In general, greater declines in soil productivity are directly associated with greater loss of soil from erosion and displacement, loss of soil organic matter, changes in vegetation composition, removal of whole trees and branches, and increased bulk density from compaction. The causal factors for declining soil productivity include improper implementation of vegetation management activities, road construction and maintenance, and excessive livestock grazing pressure. More recently, large-scale, uncharacteristic wildfires have increased the number of landscapes with declining soil productivity through reduction in effective vegetative ground cover and loss of root strength, which has resulted in increased soil erosion rates.

Overall, soil productivity across the interior Columbia Basin is stable or decreasing.

Soil productivity may currently be higher in areas where fire has been suppressed and where organic matter and vegetation have not been removed. However, the unnaturally high amounts of vegetation and large woody material put these areas at risk for uncharacteristic fire intensity and severity, which can lead to decreased soil productivity because of high rates of erosion, loss of organic matter, woody material, and nutrient reservoirs.

Hydrology and Watershed Processes

Background: Watershed Hierarchies and Functions

Watersheds are natural divisions of the landscape and the basic functioning unit of hydrologic systems. Watersheds can be considered in a variety of scales

ranging from continents to individual hillslopes or streams (Figure 2-5). Watersheds are hierarchical—smaller ones nest within larger ones. Commonly used terms referring to watershed scales are shown in Table 2-1a and illustrated in Figure 2- 1, both of which are found in the Introduction to this chapter.

Landforms contained within watersheds are also hierarchical. Valleys nest within watersheds, and their form is in part controlled by watershed physiography and geologic history. Streams and rivers flow through valleys, and channel form is influenced by interactions between streams and valleys. Individual features within channels, such as pools and riffles, reflect stream-channel processes and history, and as a result, are the culmination of watershed processes at multiple scales. These natural hierarchies make watersheds an appropriate context for considering many ecological processes.

Geoclimatic processes such as rainfall, erosion, and streamflow and sediment regimes commonly merge on a watershed basis to shape and form the landscape. Environmental changes in soil, vegetation, topography, and chemicals result in changes in the quantity and quality of water, sediment, and organic material that flow through a watershed. The response of a particular watershed to environmental change varies considerably because each watershed is unique. Factors that govern how a watershed may respond to environmental change include the size and location of these changes, the physical and biological characteristics of the watershed, and the history of natural and human disturbances.

Figure 2-5. Ecosystem Scales. Watersheds and ecosystems can be considered on a variety of scales. The ICBEMP project focuses its attention on the broader scales illustrated in the top two boxes.

Background: Streams, Rivers, and Lakes

Movement of water is one of the fundamental ways to transfer energy and materials in ecosystems (Figure 2-6). Water in streams and rivers transports sediment, organic material, nutrients, and aquatic organisms, resulting in constant redistribution and shaping of landforms and stream channels. The wide variety of water bodies, with their associated energy and food sources, provide abundant and diverse habitats for water-dependent plant and animal species.

Stream flow regimes and water quality can be affected by modifications to watershed processes occurring from both natural disturbances and land management activities. A discussion on the current conditions of the physical characteristics of stream flow and water quantity in the project area is included in this section. Water quality, and water quantity effects on water quality, is a key component of riparian and aquatic habitats. Moreover, land managers have some degree of influence over the condition of aquatic ecosystems on Forest Service- or BLM-administered land through the management of water quality and quantity. Because of the water quality linkages to riparian and aquatic habitats, water quality is discussed in the Aquatic/Riparian section later in this chapter.

Streams, rivers, and lakes are a focus for human activities. As human population in the project area increases, and as demands for food, energy, transportation networks, and recreation opportunities expand, uses of stream and river systems increase. These uses have resulted and will continue to result in escalating conflicts over water and stream channels—not only among competing human uses but also between human uses and ecological requirements of the native biota.

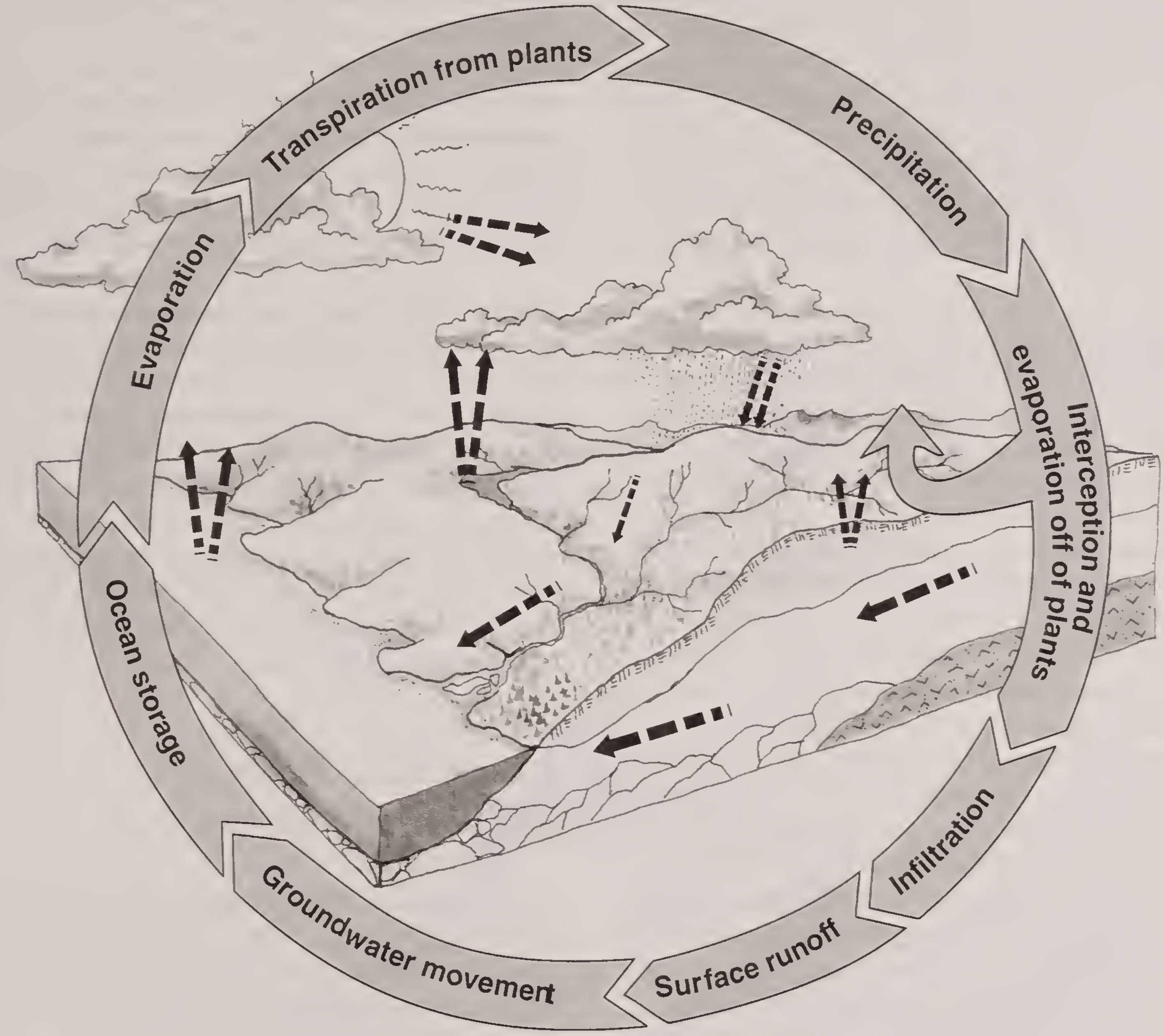


Figure 2-6. Hydrologic Cycle.

Movement of water is one of the fundamental ways to transfer energy and materials in ecosystems. The complex hydrologic cycle links water in the air, on the surface of the earth, and below ground. The interactions of the hydrologic cycle provide the key to processes (such as flooding) that route and deliver water, wood, and sediment to streams and connect the streams to their floodplains, adjacent riparian areas, and uplands. The wide variety of water bodies, with their associated energy and food sources, provide abundant and diverse habitats for water-dependent plant and animal species.

Stream flow regimes and water quality can be affected by modifications to watershed processes occurring from both natural disturbances and land management activities. Disturbance and compaction of soil and changes in vegetation also can alter hydrologic relationships in a number of ways, by changing: the way water infiltrates and is stored in the soil, how effectively groundwater is recharged, how much water evaporates to the air or is transpired through plants, how much and where surface runoff occurs, the amount and timing of streamflows, and the quality and quantity of water in lakes and streams. Such changes to these interactions and processes are tied inextricably to degradation of aquatic and riparian habitats for anadromous and inland fishes and terrestrial and aquatic wildlife.

Streams, rivers, and lakes also are a focus for human recreational, food, energy, transportation, and other activities. Many of these activities have resulted in further changes in the hydrologic cycle, and they play a role in escalating conflicts over water and stream channels—not only among competing human uses but also between human uses and ecological requirements of native plants and animals.

Stream Channel Processes, Functions, and Patterns

Water, sediment, solutes, and organic material derived from hillslopes and their vegetative cover flow into and through streams and rivers. The shape and character of stream channels constantly and sensitively adjust to the flow of these materials by adopting distinctive patterns such as pools-and-riffles, meanders, and braids (Leopold et al. 1964). The vast array of physical channel characteristics combined with energy and material flow, provides diverse habitats for a wide variety of aquatic and riparian-dependent species.

The varied topography within the project area, coupled with the irregular occurrence of channel-affecting processes and disturbance events such as fire, debris flows, landslides, volcanic activity, drought, and extreme floods, results in a mosaic of river and stream conditions that is dynamic in space and time under natural conditions (Reeves et al. 1995). The primary consequence of most of these disturbances is to directly or indirectly provide large pulses of sediment and wood into stream systems. As a result, most streams and rivers in the project area probably undergo cycles of channel change on a timescale ranging from years to hundreds of years in response to episodic inputs of wood and sediment. The types of disturbance, such as fire, flood, or debris flow, that affect the morphology of a particular channel depend on watershed characteristics, channel size, and position of the channel within the watershed (Reeves et al. 1995; Grant and Swanson 1995). Many aquatic and riparian plant and animal species have evolved in concert with the dynamic nature of stream channels; see the Aquatic Habitats section, later in this chapter, for details.

In order to guide understanding and management of streams and rivers, stream classification systems (such as Rosgen 1994; Montgomery and Buffington 1993) have been established on the basis of distinctive patterns of stream behavior. These classifications are primarily derived from consideration of stream slope and confinement (relating to the stream's ability to move and erode its banks and bed). In general, stream types range from steep and confined channels that generally consist of step-pool and cascade-dominated streams (Rosgen "A"; Montgomery and Buffington "source"); to moderate gradient and moderately confined rapid-dominated channels (Rosgen "B"; Montgomery and Buffington "transport"); to low gradient, unconfined, pool-and-riffle dominated channels (Rosgen "C, D, and E"; Montgomery and Buffington "response"). Other stream types include: gullied, or streams actively eroding their streambeds and streambanks (Rosgen "G") and low gradient, entrenched, wide streams (Rosgen "F").

In general, steeper channels (slopes greater than four percent) are commonly found in the headwater or mountainous portions of a landscape, and are less sensitive to watershed disturbances because of their high degree of confinement and their position high in the watershed unless the soils are highly erosive (Figure 2-7). Once disturbed, however, steep and confined streams may take considerable time to recover to their previous condition. Channels with slopes between two and four percent generally contain abundant rapids and steep riffles.

Lower-gradient streams (slopes less than two percent) are generally larger, and under natural conditions they meander and migrate freely within wider valleys (Figure 2-8). Low gradient streams and rivers commonly have numerous side channels and high water channels and generally contain the most biologically productive aquatic ecosystems. These low-gradient channels are generally sensitive to cumulative and local watershed disturbances, but they have the ability to recover quickly when natural hydrologic and sediment regimes are present.

Stream Flow Regimes and Water Quantity

Within the interior Columbia Basin, there are approximately 254,700 miles of streams and rivers (including larger irrigation canals) and several thousand lakes mapped at the scale of 1:100,000. Most of the lakes are small (surface areas smaller than 12 acres) and are at high elevations (higher than 5,000 feet). Forty-nine percent of these streams and a majority of the lakes are on Forest Service- or BLM-administered lands.

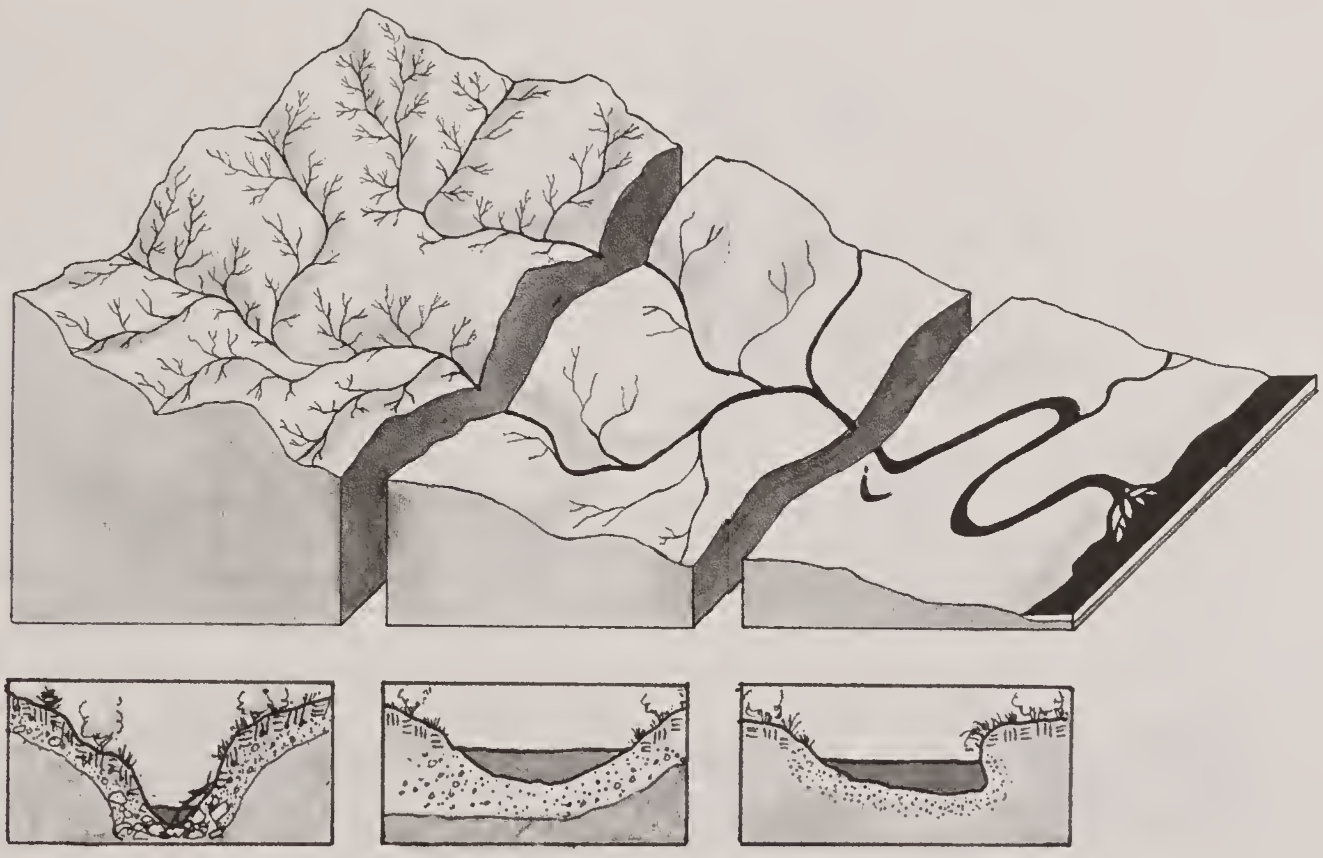
Most of the streams ultimately drain into the Columbia River, which has a drainage area of 237,000 square miles (152 million acres) and an average annual discharge of 140 million acre feet at the town of The Dalles, Oregon. About 35 percent of the flow at The Dalles originates from Canada. A large part of the flow from the southeastern portion of the project area enters the Columbia River via the Snake River, which has a drainage area of 108,500 square miles (69 million acres) and an average annual discharge of 40 million acre feet near its confluence with the Columbia River in south-central Washington.

Most surface runoff results from snowfall and/or rainfall in mountainous regions, resulting in spring and summer annual peak discharges. Most streamflow in the project area results from surface runoff or

shallow groundwater flow into streams. The vast majority of streamflow originates on public lands, especially higher elevation Forest Service-administered lands. A few streams, however, in the volcanic provinces of the Columbia Plateau, Upper Klamath Basin, Northern Cascades, and Southern Cascades ERUs have significant components of inflow from ground-water. Groundwater-influenced streams provide unique terrestrial and aquatic habitats because of their relatively constant flows of cold, clear, and high-quality water. In eastern Oregon and Washington, elevations below 2,000 feet, including most BLM-administered lands, usually do not contribute significantly to streamflow (Wissmar et al. 1994). There is substantial year-to-year variability in streamflow quantity because of variability in rainfall and snowfall accumulation (McIntosh et al. 1994).

Road construction in forested environments probably has the largest effect on runoff and streamflow, although most studies investigating this issue have been outside the project area. Relatively impermeable road surfaces combined with cutbanks, fill-slopes, and roadside ditches result in decreased infiltration and increased rates of surface runoff. Roadcuts intercept subsurface flow while roadside ditches and newly formed gullies downstream from culverts extend the stream network, creating a channel system that is highly efficient in delivering surface runoff and sediments to stream channels (Harr et al. 1975, 1979; Megahan et al. 1992; Jones and Grant 1996; Wemple 1994; Ziemer 1981). Also see the discussions on roads in the economic and social considerations section and elsewhere in this chapter.

Vegetation manipulation activities can change rates and amounts of evaporation and transpiration (water use by plants), and, in some areas, can change rates and volumes of snow accumulation and snowfall. These effects are best understood for forested environ-



Steep mountain headwater streams flow swiftly through and cut deep "V" shaped valleys. Rapids, small pools, and waterfalls are commmon and densly spaced.

Foothill streams flow through moderately confined valleys. Pools and riffles are common. The valley broadens and the river begins to meander.

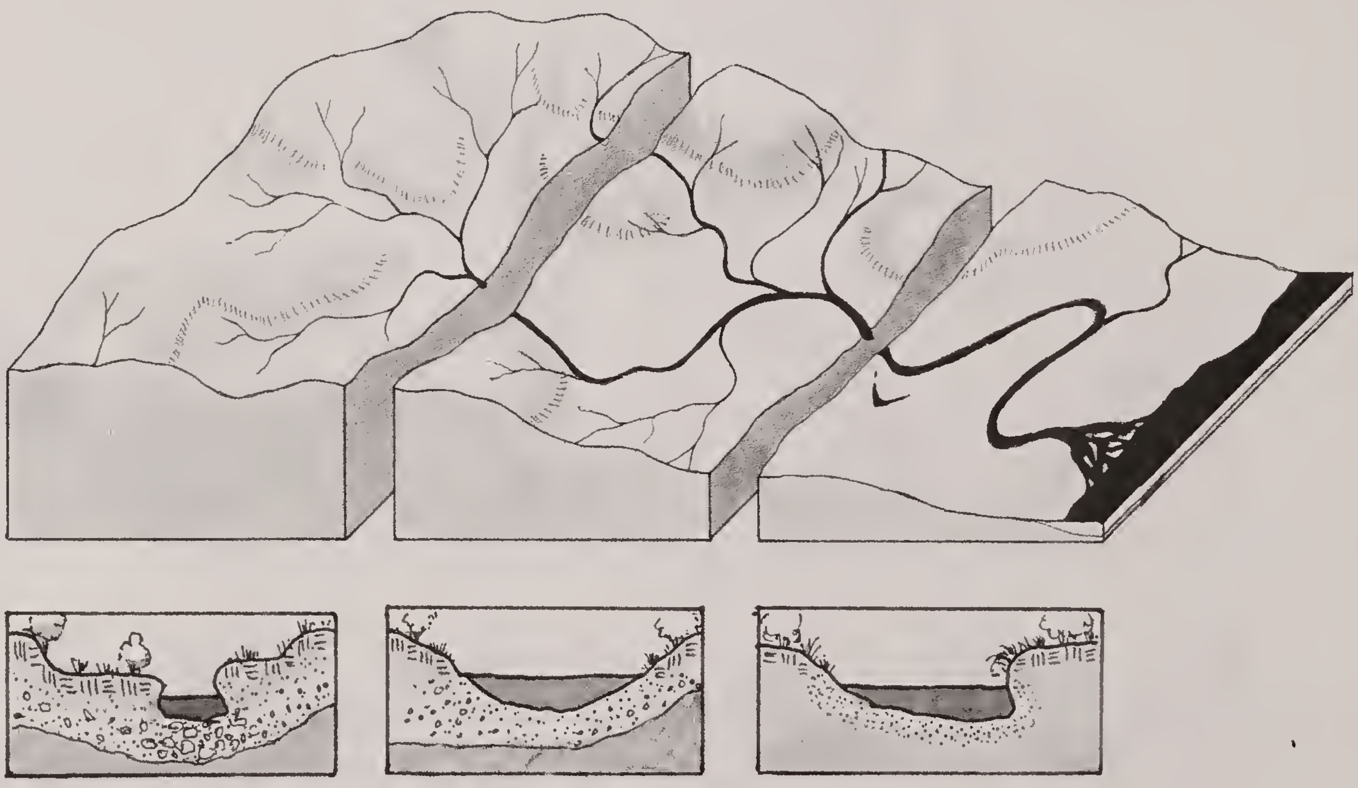
The river continues to meander slowly across a broad, nearly flat valley with wide floodplains. Large pools and off-channel standing water is common.

Figure 2-7. Steep Mountain Headwaters Profile. Stream channels change in shape and velocity based on the steepness of the round slope and the amount of surface water. In general, steeper channels are commonly found in the headwater or mountainous portions of a landscape. These may be less sensitive to watershed disturbances, yet once disturbed they may be slow to recover.

ments, where, within clearcuts, snow tends to accumulate in greater amounts and melt faster than in forested areas, leading to larger and earlier peak flows (Harr 1986, King 1994). These effects are greatest in association with rain-on-snow events, during which rain falls on snowpack, causing melting and changes in the timing of runoff. This happens particularly within the "transient snow zone" found at elevations commonly between 2,000 and 5,000 feet. Although there is less clearcutting now, the hydrologic effects of past clearcuts can persist for three to four decades, depending on vegetation characteristics (FEMAT 1993). Soil compaction due to excessive livestock grazing pressure (Platts 1991), and timber harvesting activities, such as yarding and heavy equipment operation, can also result in decreased soil permeability and increased runoff (Chamberlin et al. 1991).

Current Conditions and Trends: Hydrology and Watershed Processes

Within the ICBEMP project area, humans have extensively altered stream channels by direct modifications such as channelization, wood removal, diversion, and dam-building, and also by indirectly affecting the incidence, frequency, and magnitude of disturbance events. This has affected inputs and outputs of sediment, water, and vegetation. These factors have combined to cause pervasive changes in channel conditions throughout the project area, resulting in aquatic and riparian habitat conditions much different from those that existed prior to



Gently sloped mountain headwater streams flow gradually with seasonal influxes that create two distinct channel types. Meadows are common.

Foothill streams flow through moderately confined valleys. Pools and riffles are common. The valley broadens and the river begins to meander.

The river continues to meander slowly across a broad, nearly flat valley with wide floodplains. Large pools and off-channel standing water is common.

Figure 2-8. Lower Elevation Headwaters Profile. Lower elevation headwater streams flow more slowly and create distinct channel types different from steep mountain headwater streams. Once the streams reach middle and lower gradients, the stream profile resembles that of the stream whose headwaters started in steeper mountains. Lower gradient streams generally contain the most biologically productive aquatic ecosystems and are generally sensitive to cumulative and local watershed disturbances.

More than 250,000 miles of streams and rivers of all sizes are found in the interior Columbia River basin.

extensive human alteration (Henjum et al. 1994; McIntosh et al. 1994; Wissmar et al. 1994). In general, the largest rivers, such as the Columbia and Snake rivers, have been converted from free flowing streams to a series of reservoirs. Many intermediate-sized rivers, such as the Payette, Clarks Fork, Clearwater, Grande Ronde, and Deschutes rivers, are now important transportation corridors that are flanked by roads, railroads, or both. Urban and agricultural areas, and other human structures and activities, now encroach upon their adjacent floodplains.

Pervasive changes in channel conditions throughout the project area have resulted in aquatic and riparian habitat conditions much different from those that existed prior to extensive human alteration.

Indirect effects of past land management activities are also pervasive in the project area. Mining, timber harvest, excessive livestock grazing pressure, homesteading, beaver trapping, and road-building have all altered channels by affecting the rate with which sediment, water, and wood enter and are transported through stream channels. Almost all Forest Service- or BLM-administered lands within the project area have experienced some level of resource extraction since the early 1800s. Most of the large-scale and intense operations that seriously affected channel morphology, such as in-stream dredging and overgrazing, were halted by the early 1900s (Wissmar et al. 1994). Nevertheless, the effects of past management activities clearly continue to affect channel morphology today.

Within the project area, lake conditions have been most affected by recreation and residential development. Recreation activities such as backpacking, horsepacking, recreational vehicle use, and road and trail development have resulted in damage to lake environments, particularly beaches and other near-shore areas. Recreation activities have commonly led to introduction of non-native plant and animal species, resulting in local extinction of native invertebrates, amphibians, and fish. Recreational boating has led to the introduction of numerous non-native plants, such as Eurasian watermilfoil. Large mid-elevation lakes, such as Priest and Payette lakes in Idaho, Flathead Lake in Montana, and Klamath Lake in central Oregon have been the most affected from a growing regional population seeking to live or recreate near lakes.

Water transfers and diversions for drinking water or irrigation water supply have affected and continue to affect many lakes throughout the project area, especially where drought and diversion of inflow have resulted in very low lake levels during the past several years. Dozens of moderate-sized lakes have their shorelines influenced by modification and control of their outlet streams or rivers. Regulation of lake level for water supply purposes has had effects on near-shore aquatic and wetland plant and animal communities, and on the spawning success of near-shore spawning fishes. Additionally, inter-basin water transfers have promoted the continued spread of non-native plants and animals while inhibiting natural migration routes of native species.

On Forest Service- or BLM-administered lands, management activities that have altered flow include impoundments (dams and reservoirs), water withdrawal (diversions and pumping), road construction, and vegetation manipulation. Timber harvest, fire suppression, excessive livestock grazing pressure, and associated activities have altered the timing and volume of streamflow by changing on-site hydrologic

processes (Keppeler and Ziemer 1990; Wright et al. 1990). These changes are either short or long term depending on which hydrologic processes are altered and the intensity of alteration (Harr 1983).

Scarcity of streamflow during the growing season, year-to-year streamflow variability, and the general aridity of low-elevation valleys and plains have spurred flow regulation and storage, water diversions, and groundwater withdrawal throughout the project area for irrigation, livestock tanks, flood control, hydropower, and recreation. In total, about seven million acres in the Columbia River Basin are presently irrigated, resulting in a seven to ten percent reduction of annual flow volume (Hann, Jones, Karl, et al. 1997). As a result of impoundments and diversions, most streams in the project area, especially larger ones, have significantly altered flow regimes. Consequently, habitat conditions have changed, especially for those aquatic species that have survival strategies adapted to natural flow patterns (see Aquatic Habitats section, later in this chapter). Altered flow regimes also affect channel stability by changing the rates and timing of sediment and organic-material transport. For a discussion of habitat fragmentation see Lee et al. (1997); see Jensen et al. (1997) for a discussion of streamflow variability and the integrity of hydrologic processes.

The past history of fire suppression also may have affected water quantity and quality. On rangelands, fire suppression is partly responsible for expansion of western juniper. Expansion of western juniper and increasing density can result in decreased understory vegetation (Hann, Jones, Karl, et al. 1997), which is believed to contribute to decreased soil infiltration and increased peak discharges during intense rainfall. In forested environments, increased aboveground vegetation due to fire suppression may also have resulted in increased evapotranspiration rates and decreased runoff. Where high intensity fires have increased due to fire suppression, soil porosity has decreased, thus increasing runoff and soil erosion. Fire can also cause water-repellent layers to form in soils, resulting in temporarily increased runoff (DeBano et al. 1976).

Climate

The varied topography and geographic position of the project area (relative to global ocean and atmospheric circulation patterns) result in very different climates. The climate, in turn, strongly influences ecological processes such as biological productivity, fire regime, soils, streamflow, erosion, and human uses of the land and resources. For a discussion see Jensen et al. (1997); Hann, Jones, Karl, et al. (1997); Ferguson (1998); and Ferguson (1999).

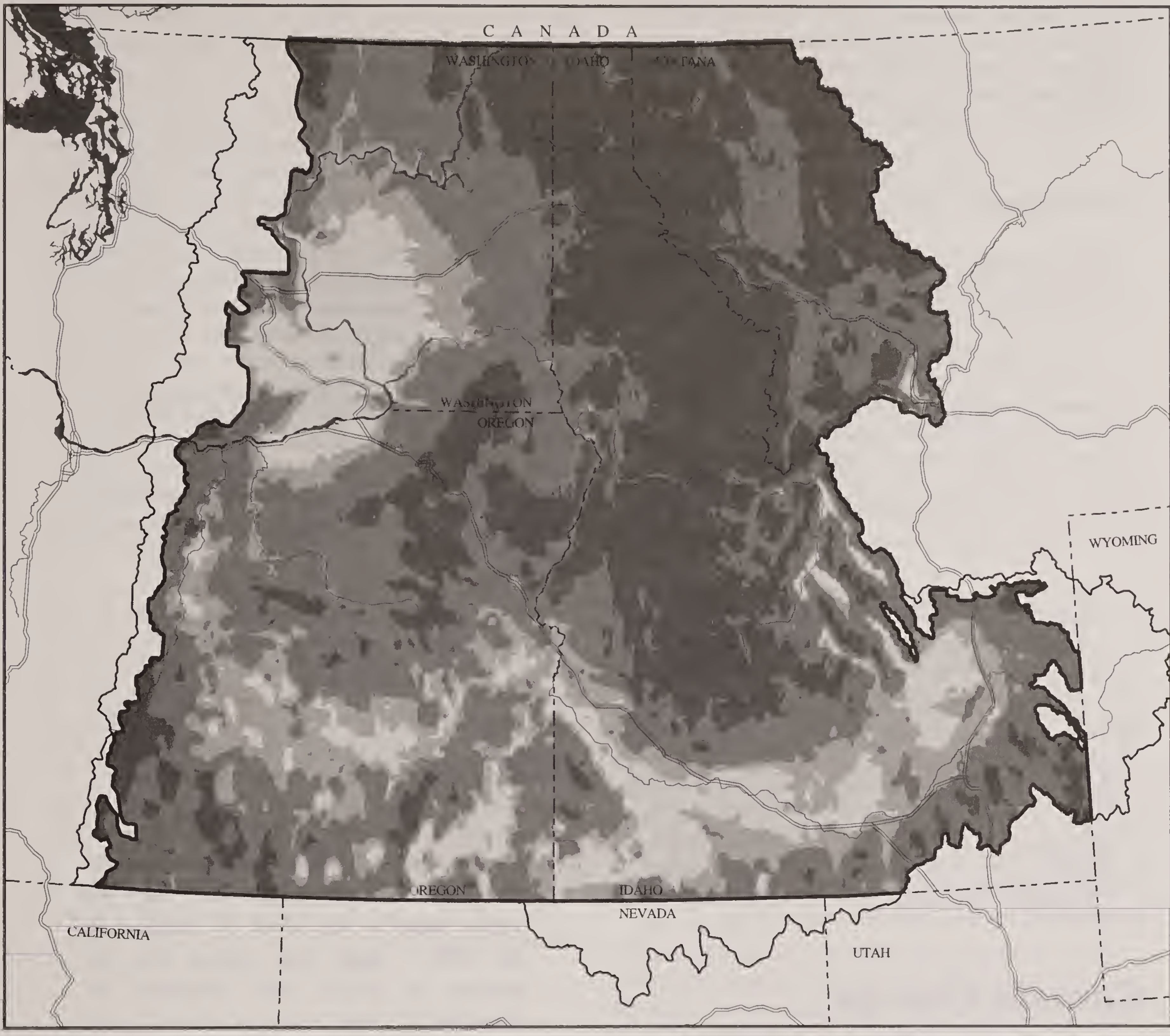
Precipitation and Temperature

Most precipitation in the project area falls in the winter when eastward moving storms enter the area. Typically, more than 80 percent of the annual precipitation falls from October to May. Expansion of the North Pacific high pressure system in the early summer effectively blocks the flow of moisture into the Pacific Northwest, resulting in generally stable, warm, and dry summers. The Cascade Range separates eastern Oregon and Washington from the maritime climate west of it, leaving the interior Columbia River Basin with a continental climate of cold winters and warm, dry summers. Map 2-3 shows the annual precipitation patterns for the project area.

Average annual precipitation ranges from more than 100 inches per year at the crest of the Cascade Range to less than 8 inches per year in the low-elevation basins and plains.

Average annual precipitation ranges from more than 100 inches per year at the crest of the Cascade Range to less than 8 inches per year in the low-elevation basins and plains. Substantial portions of the project area, especially rangelands, receive less than 12 inches of precipitation per year. In these areas, recovery of vegetation and soil from human and natural disturbance takes place much more slowly than in areas with greater rainfall. The highest precipitation is in the mountain ranges, notably the Cascade Range, the Blue Mountains, the central Idaho Mountains, and the Northern Rocky Mountains. Most precipitation falls during winter and accumulates as snow, with mean annual snowfall of 100 to 200 inches along the crest of the Cascade Range and in the Blue Mountains. Spring, summer, and fall storms provide growing season rainfall in the mountains, especially in the eastern part of the project area.

The project area experiences a wide range of temperature variation. High mountainous areas have cold winters and short, cool summers with growing



50 0 50 100 150 miles

50 0 50 100 150 km

N

Map 2-3.
Annual Precipitation

- 0 - 10 inches
- 10 - 12 inches
- 12 - 24 inches
- >24 inches

- Major Rivers
- Major Roads
- Supplemental Draft EIS Area Border

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seasons that are locally less than 30 days in the highest alpine areas. Intermontane valleys and plateaus have cool to cold winters and hot summers, resulting in growing seasons that exceed 150 to 200 days in parts of the Columbia Plateau.

Drought

Drought is defined as an absence of usual precipitation (less than 75 percent of normal), for a long enough period that there is decreased soil moisture and stream flow, thereby affecting ecological processes and human activities. All regions experience temporary, irregularly recurring drought conditions, but dry climates generally are affected most (Barry and Chorley 1982). Year-to-year climate variability generally increases with aridity. In areas with average annual precipitation of less than 12 inches, drought years occur 20 to 40 percent of the time.

Drought affects fire and rangeland management. Dry years, such as 1988 and 1994, commonly result in widespread wildfire in forested environments, especially if there have been several preceding dry years. Drought significantly reduces forage production on rangelands, which can lead to degradation of upland and riparian areas if livestock grazing is not properly managed (Vallentine 1990). Drought can also increase the susceptibility of forestlands to insect infestation. The regional drought of 1920 to 1940 in the Pacific Northwest created substantial insect infestation problems, particularly for pine species (Agee 1994).

Climate Change

Climate change is not a new phenomenon in the project area. Changing climates through time have resulted in continuing adjustments by aquatic and terrestrial ecosystems. Changes in temperature and precipitation have direct impacts, such as effects on the efficiency of photosynthesis and length of growing season; they also have indirect effects, such as alterations in fire and flood frequency. Past climate change in the project area has ranged from global-scale changes (such as the transition between glacial and interglacial periods approximately 10,000 years ago, which resulted in about a ten degree Fahrenheit increase in mean annual temperature) to smaller yet still important changes (such as the period of generally cooler temperatures that began approximately 4,000 years ago and culminated in the Little Ice Age of the 1700s and early 1800s). Over the past several decades in the Pacific Northwest and globally, there has been significant warming (one to three degrees Fahrenheit) that some scientists have attributed to increased carbon dioxide emissions and the greenhouse effect.

Vegetation is especially sensitive to climate change. Upper and lower forest boundaries in the project area have shifted up and down in elevation by hundreds of feet during the past several centuries in response to temperature changes of one to three degrees Fahrenheit (Mehringer 1995; Neitzel et al. 1991). In general, plants on the fringes of their distributions respond most sensitively and rapidly to climate change. Within the project area, such changes are expected to continue to greatly influence the area and extent of vegetation types, especially changes in elevation of the overlapping conifer and steppe communities (Mehringer 1995). Vegetation responds to climate change in different directions and at different rates, reassembling in new and sometimes unpredictable associations that are constantly changing (Graham and Grimm 1990).

Air Quality

Background

Air quality in the project area was not pristine before it was settled by Europeans in the 1800s. Smoke from wildland fires has occurred in project area ecosystems for thousands of years.

Air quality in the project area was not pristine before it was settled by Europeans in the 1800s, particularly with regard to smoke. Many historical accounts refer to the presence of smoke and burned areas in the interior Columbia Basin, the Harney Basin, near the mouth of the Umatilla River, on the western slope of the Blue Mountains, and along the section of the Oregon Trail from the juncture of the Boise and Snake Rivers to the Columbia River (Robbins and Wolf 1994). Levels of smoke declined as fire was excluded from forests, particularly after the advent of organized fire suppression in the 1930s. Brown and Bradshaw (1994) concluded that levels of smoke in the Bitterroot Valley, Montana, were 1.3 times greater prior to settlement in the 1800s than they have been recently. Agee (1993) documents that fire has played a role as a disturbance agent in the development of Pacific Northwest ecosystems.

Emissions from wildland fires have occurred in project area ecosystems for thousands of years. For example, layers of charcoal found in the Sheep Mountain Bog near Missoula, Montana, and the Williams Lake Fen north of Cheney, Washington, provide evidence of wildland fire at varying intervals from 10,000 years ago to the present (Johnson et al. 1994). Fires from as long as 4,000 years ago are evident from charcoal found at Blue Lake, near Lewiston, Idaho. Several sites show significantly increased levels of charcoal starting about 1,000 years ago, attributed to burning by Native Americans.

Current Conditions

Conditions Related to the Clean Air Act

The Clean Air Act, passed in 1955 by the Congress and amended several times, is the primary legal instrument for air resource management. The Clean Air Act requires the Environmental Protection Agency (EPA) to, among other things, identify and publish a list of common air pollutants that could endanger public health or welfare. These commonly encountered pollutants, referred to as "criteria pollutants," are listed by the EPA along with the results of studies documenting the health effects of various concentrations of each pollutant. For each criteria pollutant, the EPA has designated a concentration level above which the pollutant would endanger public health or welfare. These levels are called the National Ambient Air Quality Standards (NAAQSs).

To date, NAAQSs have been established for six criteria pollutants: sulfur dioxide ($S0_2$), particulate matter (PM_{10} and $PM_{2.5}$), carbon monoxide (CO), ozone (O_3), nitrogen oxides (No_x), and lead (Pb). There are exceptions, but generally these standards are not to be violated anywhere the public has free access within the United States. If NAAQSs are violated in an area, the area is designated as a "non-attainment area," and the state is required to develop an implementation plan to bring it back into compliance with these standards. To help protect air quality, the Clean Air Act (Section 118) requires federal agencies to comply with all federal, state, and local air pollution requirements. Class 1 airsheds and non-attainment areas are shown in Map 2-4.

Pollutants such as oxides of nitrogen and sulfur are of concern to federal land managers because of their potential to cause adverse effects on plant life, water quality, and visibility. However, the sources of these pollutants are generally associated with urbanization and industrialization rather than with natural resource management activities. Therefore, these pollutants will not be considered further in this EIS. On the other hand, particulates, carbon monoxide, and ozone are criteria pollutants that can be created by fire; these pollutants are discussed here. The pollutant of greatest concern for management activities in the project area is particulate matter (PM).

Three elements of the Clean Air Act generally apply to management activities that produce emissions in the project area:

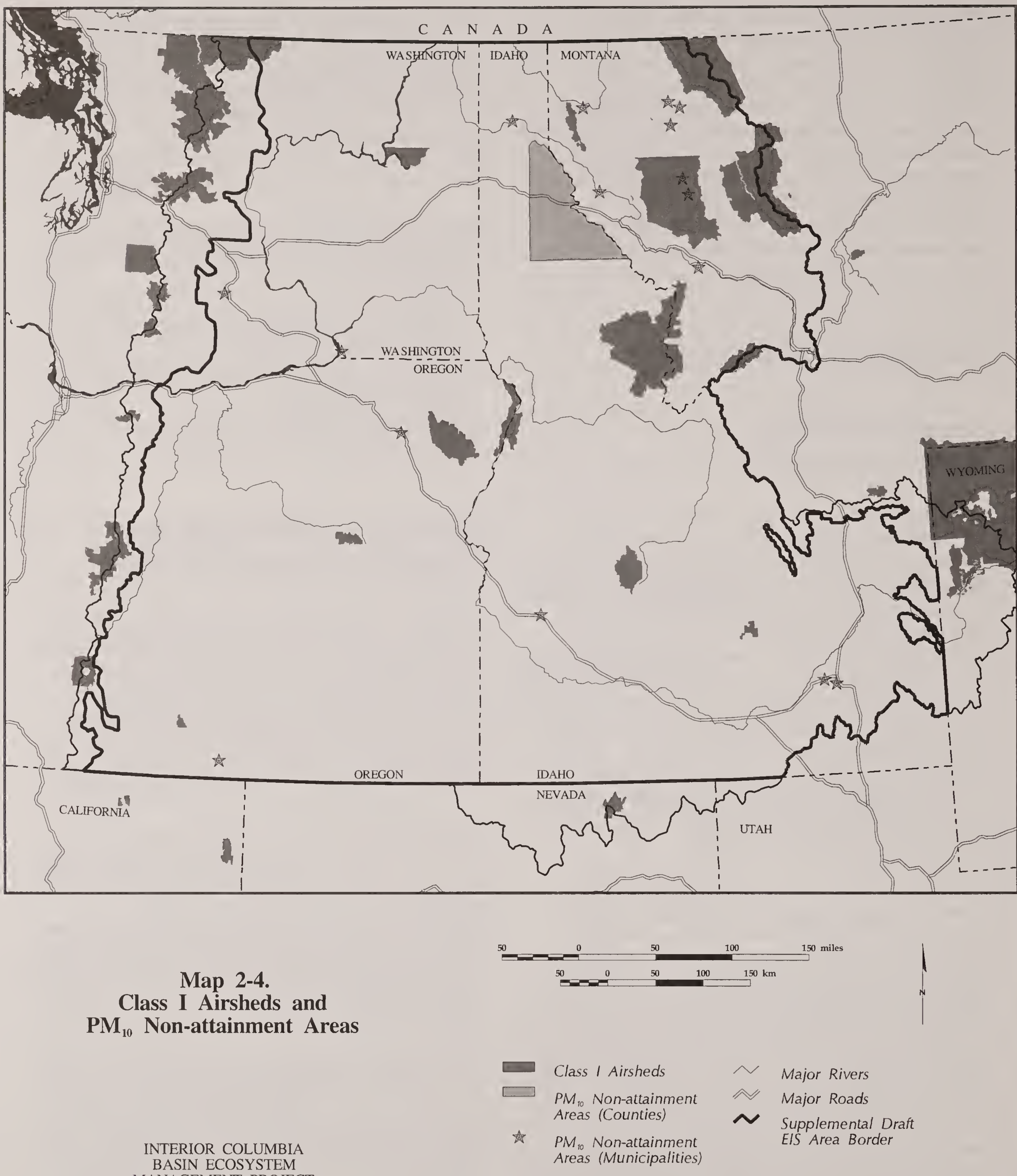
1. Protection of National Ambient Air Quality Standards (Section 109);
2. Conformity with State Implementation Plans (Section 176(c)); and
3. Protection of Visibility in Class I Areas (Section 169A).

Protection of National Ambient Air Quality Standards (NAAQSs)

Particulate matter produced by land management activities or natural events on federally administered lands originates from wildfire, prescribed burning, road or wind-blown dust, volcanic eruptions, construction, mining, and vehicle use. However, most particulate matter of concern is produced from fire, and most of this is *less* than 10 micrometers (PM_{10}) in diameter, which is the size class that is regulated.

Because fire and smoke are a natural part of forestland and rangeland ecosystems, PM_{10} produced from fire does not seriously affect these ecosystems. However, it does have effects on human health. PM_{10} particles can be drawn deep into the alveolar region of the lungs, the part of the respiratory system most sensitive to chemical injury (Morgan 1989 in Sandberg and Dost 1990). Wood smoke also contains carcinogenic compounds.

Ozone is a photochemical pollutant formed on warm sunny days from nitrogen dioxide and hydrocarbon emissions, which are byproducts of burning. The chemistry of ozone formation is poorly understood; however, it is known that ozone is present in the smoke plume downwind of large fires. However, smoke plumes that do not rise (and therefore are likely to be encountered by humans) generally result from low intensity fires, which have much lower emissions of ozone. Also, the occurrence of fires is generally dispersed geographically and over time. Therefore, there is little risk to human health from exposure to ozone resulting from fire. Because fire is



Map 2-4.
Class I Airsheds and
PM_{10} Non-attainment Areas

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Photo by Karen Wattenmaker.

Smoke emissions from fires can stay suspended in the air for many miles, potentially affecting air quality.

a natural event within forestland and rangeland areas, to some extent ozone produced by fire is also a natural event, and these ecosystems have some natural adaptation to its effects.

Carbon monoxide is generated mainly by incomplete combustion of carbon. There have been few, if any, measured effects to the ecosystem from carbon monoxide. It is generated during wildland burning but is rapidly diluted at short distances from a fire and, therefore, poses little or no risk to community health (Sandberg and Dost 1990). However, carbon monoxide can be a health concern for firefighters on the fireline depending on concentration, duration, and level of activity (USDA Forest Service and John Hopkins University 1989).

Many *other* non-criteria, but potentially toxic, pollutants are emitted by wildland fire, including polynuclear aromatic hydrocarbons (sometimes referred to as PAHs) and aldehydes. Effects on human health vary by levels of exposure to these pollutants emitted during combustion. Some polynuclear aromatic hydrocarbons are known to be potential cancer-causing agents; other components, such as aldehydes, are acute irritants. Many of these air toxics dissipate or bind with other chemicals soon after release, making it difficult to estimate human exposure and consequential health effects. Additionally, the health and welfare effects of air toxics released by prescribed burning or wildfires have not been directly studied.

Conformity with State Implementation Plans

Non-attainment areas are those that have violated National Ambient Air Quality Standards. None of the national forests or BLM districts in the project area lie within non-attainment areas.

The Clean Air Act requires each state to develop, adopt, and implement a State Implementation Plan to ensure that the NAAQSs are attained and maintained for the criteria pollutants. These plans must contain schedules for developing and implementing air quality programs and regulations. State Implementation Plans also contain additional regulations for areas that have violated one or more of the NAAQSs (non-attainment areas).

The general conformity provisions of the Clean Air Act (Section 176(c)), prohibit federal agencies from taking any action *within a non-attainment area* that causes or contributes to a new violation of the NAAQSs, increases the frequency or severity of an existing violation, or delays the timely attainment of a standard. Federal agencies are required to ensure that their actions conform to applicable State Implementation Plans. The Environmental Protection Agency developed and finalized criteria and procedures for demonstrating and ensuring conformity of federal actions to State Implementation Plans. However, as written, they apply only to federal actions that occur within non-attainment areas.

As of the printing of this EIS, none of the national forests or BLM districts in the project area lie within non-attainment areas. Therefore, requirements of the conformity regulations do not apply to management actions proposed in this EIS. However, federal actions must still comply with State Implementation Plans.

Protection of Visibility in Class I Areas

Congress, in the Clean Air Act, declared as a national goal "the prevention of any future, and the remedying of any existing, impairment of visibility in mandatory Class I federal areas when the impairment results from manmade air pollution". Class I areas in the project area include wilderness areas of at least 5,000 acres or national parks of at least 6,000 acres that were in existence prior to 1977. Clean Air Act amendments have also enabled tribes to classify areas as Class I areas. Map 2-4 shows the federal Class I areas in the project area.

To assure protection of visibility in Class I areas, the states of Oregon and Washington have adopted visibility protection plans as part of their State Implementation Plans, which dictate when and how much burning can take place. The State Implementation Plans for Idaho and Montana do not include visibility protection plans.

Class I areas are subject to the most limiting restrictions regarding how much additional pollution can be added to the air. Fine particulate matter, generally less than 2.5 microns in diameter ($PM_{2.5}$), is the primary cause of visibility impairment. Emissions from prescribed burning, which stay suspended for many miles, are in the 0.1 to 2.5 micron size class and generally reduce visibility.

Visibility was monitored and documented for many of the Class I areas in Oregon and Washington from 1983 to 1992 (Boutcher 1994). The study shows that visibility has improved in and around Class I wildernesses areas west of the Cascade Range, and it has remained stable east of the Cascades. This can be attributed to a reduction in prescribed burning and to Oregon and Washington State Implementation Plans. Comparable data and studies are not available for the remainder of the project area.

Results of a 1990 National Park Service study of visibility in national parks and wilderness areas in the Washington Cascade Range (Malm et al. 1994) indicated that burning vegetation contributed approximately 17 percent of the visibility impairment found in the study area, with 53 percent from sulfates, 9 percent from nitrates, and 20 percent from soil and other causes. These parks are on the western edge of the project area, but information on particle composition and source regions is relevant to the project area because these fine particles are transported over long distances. While the emissions that affected the Park Service study came primarily from industrial and urban emissions in the Puget Sound region, it is logical to expect that in the project area, emissions from land management activities would account for a larger proportion of particulates.

Managing Emissions From Prescribed Fire

Under the Clean Air Act, state and local governments and American Indian tribes have the authority to adopt their own air quality rules and regulations. These rules are incorporated into their State Implementation Plans if they are equal to, or more protective than, federal requirements. For example, Montana, Oregon, and Washington have officially adopted smoke management programs into their State Implementation Plans. In parts of Idaho, memoranda of understanding have been signed by the states and federal land managers establishing parameters for managing emissions from prescribed burning.

Tracking Emissions

An emissions information system is used in Oregon, Washington, Montana, and northern Idaho to quantify prescribed fire emissions and to track changes in emission productions within their jurisdictions. Federal land managers have an obligation to complete smoke management reports and apply appropriate mitigation measures to reduce potential impacts on air quality (EPA 1992). Managers use, although they are not limited too, available computer software to estimate fuel consumption, emissions, and smoke dispersion from prescribed burns.

Monitoring Air Quality

Several different monitoring networks currently measure air quality in the project area. The most extensive of these are the State and Local Air Monitoring Stations/National Air Monitoring Stations. Operated by the states, this monitoring network is used to determine whether the National Ambient Air Quality Standards are met. Monitors in this network are concentrated in population centers.

Federal agencies also operate monitors at five sites within or near the project area. These monitoring sites measure particulates and changes in visibility, using filters that can be analyzed to determine the relative contribution of different sources of particulate matter. In addition to monitoring pollutant concentrations, state and federal agencies collect and archive the following types of data about prescribed fires: location, acres burned, moisture content of fuels, tons to be consumed, and emissions to be released.

Landscape Dynamics Component : Terrestrial (Upland) Vegetation

Key Terms Used in This Section

Cover type — A vegetation classification depicting a genus, species, group of species, or life form of tree, shrub, grass, or sedge.

Disturbance — Refers to events that alter the structure, composition, or function of terrestrial or aquatic habitats. Natural disturbances include, among others, drought, floods, wind, fires, wildlife grazing, and insects and pathogens. Human-caused disturbances include actions such as timber harvest, livestock grazing, roads, and the introduction of exotic species.

Downed wood — A tree, large shrub, or part of a tree or shrub that is dead and laying on the ground.

Ecological significance — In the *Scientific Assessment* and this EIS, refers to a specific method of judging the significance of changes (from historical) of cover types and terrestrial community types, based on class changes, regional changes, and departure indices. See Hann, Jones, Karl, et al. (1997, page 409) for details.

Excessive livestock grazing pressure — Grazing pressure that results in a decline in physiological vigor of plants (such as decline in seeds or other reproductive parts or decline in root growth or other growth), resulting in decreased ability of the plant to compete for resources and also resulting in alteration of plant species composition in plant communities.

Exotic Species — A plant or animal species introduced from a distant place; not native to the area.

Grazing pressure — The ratio of forage demand to forage available, for any specified forage, at any point in time. Thus, as forage demand increases relative to forage available, grazing pressure increases, and vice-versa.

Herbivore — An animal that subsists principally or entirely on plants or plant materials.

Invasion (plant) — The movement of a plant species into a new area outside its former range.

Landscape composition — The types of stands or patches of vegetation present across a given area of land.

Landscape structure — The mix and distribution of stand or patch sizes across a given area of land. Patch sizes, shapes, and distributions are a reflection of the major disturbance regimes operating on the landscape.

Noxious Weed — A plant species designated by federal or state law as generally possessing one or more of the following characteristics: aggressive and difficult to manage; parasitic; a carrier or host of serious insects or disease; or non-native, new, or not common to the United States. According to the Federal Noxious Weed Act (PL 93-639), a noxious weed is one that causes disease or has other adverse effects on humans or their environment and therefore is detrimental to the agriculture and commerce of the United States and to public health.

Old Forest — (a) **Old single story** forest refers to mature forest characterized by a single canopy layer consisting of large or old trees. Understory trees are often absent, or present in randomly spaced patches. It generally consists of widely spaced, shade-intolerant species, such as ponderosa pine and western larch, adapted to a nonlethal, high frequency fire regime. (b) **Old multi-story** forest refers to mature forest characterized by two or more canopy layers with generally large or old trees in the upper canopy. Understory trees are also usually present, as a result of a lack of frequent disturbance to the understory. It can include both shade-tolerant and shade-intolerant species, and is generally adapted to a mixed fire regime of both lethal and nonlethal fires.

Other characteristics of old forests include: variability in tree size; increasing numbers of snags and coarse woody debris; increasing appearance of decadence, such as broken tops, sparse crowns, and decay in roots and stems; canopy gaps and understory patchiness; and old trees relative to the site and species.

Patch (stand) — An area of uniform vegetation that is different from surrounding vegetation in its structure or

composition. Examples might include a patch of forest surrounded by a cut-over area or a patch of dense young forest surrounded by a patch of open old forest.

Regeneration —The process of establishment of new plant seedlings whether by natural means or artificial measures (planting).

Seral — Refers to the stages that plant communities go through during succession. Developmental stages have characteristic structure and plant species composition. In a forest, for example, early seral forest refers to seedling or sapling growth stages; mid seral forest refers to pole or medium saw timber growth stages; and mature or late seral forest refers to mature and old-growth stages.

Shade-intolerant — Species of plants that need full sunlight to establish and grow. Generally these are fire-adapted species.

Shade-tolerant — Species of plants that can establish and grow in the shade. Generally these are more fire-sensitive species.

Source habitat —The composite of vegetation characteristics that contribute to terrestrial species population maintenance or growth in a specified time and space. See Glossary for more detail.

Species composition —The mix of different species that make up a plant or animal communit. For example, the minx of different species of trees that are growing in a forest. Can include both shade-intolerant and shade-tolerant species.

Stand (patch) density —The number of trees growing in a given area, usually expressed in terms of trees per acre.

Stand (patch) structure —The mix and distribution of tree sizes, layers, and ages in a forest. Some stands are all one size (single story), some are two story, and some are a mix of trees of different ages and sizes (multi-story). (See Table 2-6 a for structural stages used in this EIS to describe forest stand structure.)

Structural stage —A stage of development of a vegetation community that is classified on the dominant processes of growth, development, competition, and mortality.

Succession —A predictable progression in structure and composition of plant and animal communities over time. Conditions of one plant community or successional stage create conditions that are favorable for the establishment of the next stage. The different stages in succession are often referred to as seral stages.

Terrestrial Communities — Groups of cover types with similar moisture and temperature regimes, elevational gradients, structures, and use by vertebrate wildlife species.

Terrestrial Family —An aggregate of groups of broad-based terrestrial vertebrate species of focus for the ICBEMP, organized into "families" based on habitat requirements (Wisdom et al. in press). Twelve Terrestrial Families are discussed in this EIS.

Summary of Conditions and Trends

The following trends have been noted on the landscape of the project area because of departures from natural disturbance and successional processes since historical times. These broad-scale changes in the landscape have influenced the susceptibility of ecosystems to uncharacteristic wildfires, noxious weed invasion, and large-scale insect and disease events, and have reduced the extent of habitat for many wildlife species.

- Interior ponderosa pine has decreased across its range, with a significant decrease in the amount of old single story structure. The primary transitions were to interior Douglas-fir and grand fir/white fir.
- There has been a loss of the large tree component (live and dead) within roaded and harvested areas. This loss affects terrestrial wildlife species closely associated with these old forest structures.
- Western larch has decreased across its range. The primary transitions were to interior Douglas-fir, lodgepole pine, or grand fir/white fir.
- Western white pine has decreased by 95 percent across its range. The primary transitions were to grand fir/white fir, western larch, and shrub/herb/tree regeneration.
- The whitebark pine/alpine larch cover type has decreased by 95 percent across its range, primarily through a transition into the whitebark pine cover type. Overall, however, the whitebark pine cover type has also decreased, with compensating increases in Engelmann spruce/subalpine fir.
- Generally, mid seral forest structures have increased in dry and moist forest potential vegetation groups, with a loss of large, scattered, residual, shade-intolerant tree components and an increase in density of smaller diameter shade-tolerant trees.
- Increased fragmentation and loss of connectivity within and between blocks of habitat, especially in the shrub steppe and riparian areas, have isolated some habitats and populations and reduced the ability of wildlife populations to move across the landscape, resulting in long-term loss of genetic interchange.
- Increasing human population in the project area has resulted in an increase in access and human activity for all types of uses. These uses can increase wildlife displacement and vulnerability to mortality, can fragment habitat, and can allow for access of exotic plants into new locations. In some places road density has increased to the point where many wildlife species will leave the area to avoid human activity.
- Rangeland noxious weeds are spreading rapidly and in some cases exponentially throughout the project area.
- Woody species encroachment by and/or increasing density of woody species (sagebrush, juniper, ponderosa pine, lodgepole pine, Douglas-fir), especially on the dry grassland and cool shrublands, have reduced herbaceous understory and biodiversity.
- Cheatgrass has taken over many dry shrublands, increasing soil erosion and fire frequency and reducing biodiversity and wildlife habitat. Cheatgrass and other exotic plant infestations have simplified species composition, reduced biodiversity, changed species interactions and forage availability, and reduced the system's ability to buffer against change or act as wildlife strongholds in the face of long-term environmental variation.
- Degradation of riparian areas and subsequent loss of riparian vegetation cover has reduced riparian ecosystem function, water quality, and habitat for many aquatic and terrestrial species. (See Aquatics section for riparian area details.)
- Expansion of agricultural and urban areas on non-federal lands has reduced the amount of some rangeland potential vegetation groups, most notably dry grassland, dry shrubland, and riparian potential vegetation groups (PVGs). Changes in some of the remaining habitat patches due to fragmentation, exotic species, disruption of natural fire cycles; overuse by livestock and wildlife; and loss of native species diversity have contributed to a number of wildlife species declines, some to the point of needing special attention (such as sage grouse, Columbian sharp-tailed grouse, California bighorn sheep, pygmy rabbit, kit fox, and Washington and Idaho ground squirrels).

Introduction to Terrestrial (Upland) Vegetation

Terrestrial vegetation in the ICBEMP project area is highly diverse, ranging from moist areas near the crest of the Cascades, to the Continental Divide in the Rocky Mountains, and to dry areas in the northern Great Basin.

The varying soils and climates support a diversity of plant species, from those that require moist sites—such as western hemlock, western redcedar, and huckleberries—to dry-land species such as sagebrush and blue bunch wheatgrass. More than 12,000 plant species are known in the project area. In the mountains, tree species range from mountain hemlock and subalpine fir at the higher elevations, to ponderosa pine in the valley bottoms. Mixed conifer forests dominated by white fir, grand fir, or Douglas-fir occupy many of the mid elevation forests. Lodgepole pine forests are also found throughout much of the project area. Huckleberries, buck brush, alder, and sagebrush are some of the shrubs found in project area forests. Juniper, sagebrush, bitterbrush, and associated bunchgrasses occupy many low-elevation drier sites. These mosaics of vegetation include productive riparian areas that support willows, sedges, and other similar species. In the absence of cultivation, sagebrush and grasses dominated the prairies and plains. Native Palouse prairie vegetation today is scarce in northern Idaho and eastern Washington, where exotic plants now dominate large areas. See Jensen et al. (1997) for descriptions of the physical environment and Hann, Jones, Karl, et al. (1997) for descriptions of historical and current patterns of vegetation and landscape change. In addition, plant species important to American Indians for food or spiritual uses are found in many locations. Plants used as food include camas, bitterroot, chokecherry, onion, cattail, and elderberry.

Because of the wide variety of plant species and landscape forms distributed throughout the project area, habitats for a wide variety of wildlife are found in the mountains, valleys, and rangelands of the basin. Approximately 13,000 terrestrial plant and animal species were considered in the Terrestrial Ecology Assessment (Marcot et al. 1997). Wisdom et al. (in press) conducted an in-depth analysis of habitat requirements of 91 species that represented those 13,000 species.

Grizzly bears, black bears, and mountain lions are some of the more notable wildlife species in the project area. Highly prized game species include Rocky Mountain elk, mule deer, and white tail deer. The bald eagle and northern goshawk are important rapters that prey on squirrels, chipmunks, woodpeckers, and a host of other species. Prominent rangeland wildlife species are pronghorn antelope, bighorn sheep, jack rabbits, sage grouse, and numerous reptiles.

How Vegetation Was Classified

There are many different ways to classify vegetation, based on various factors such as: conditions, vegetation structure, site moisture conditions, site fertility, heat, climax vegetation, overstory, understory, current vegetation, and other criteria or combinations. Hann, Jones, Karl, et al. (1997) used several broad-scale variables to assess regional levels of change: potential vegetation types, potential vegetation groups, cover types, structural stages, physiognomic types, physiognomic type groups, terrestrial communities, disturbance types, roads, and land ownership. The broad-scale vegetation attributes of the current period were derived from 1991 satellite imagery. The historical or "native" regime was simulated.

In this EIS, individual cover type-structural stage combinations were nested within appropriate terrestrial communities, which were nested within potential vegetation groups in order to provide a logical context for understanding of current trends, the management direction, and projected effects of alternatives. These are described more fully on the following pages.

Historical conditions—The vegetation types, structural stages, and dynamics, and other conditions and processes that are likely to have occurred around the time of pre-European settlement, approximately the mid 1800s. This time period is used only as a reference point to understand ecological processes and functions. In many cases it is neither desired nor feasible to return to actual historical ecological conditions.

Potential Vegetation Types and Groups

The term *potential vegetation type* (PVT) is used in this EIS to represent the entire combination of species that might grow on a specific site. In the absence of disturbance and given enough time, climax vegetation will occupy any given site. The potential vegetation type is often named for this climax vegetation, but may also be named for an "indicator" species. The vegetative cover present at any one time can vary based on past disturbances; species other than those listed for the PVT may occur on the site through time. Thus, the name given to the PVT (such as "dry Douglas-fir with ponderosa pine") is simply an indicator and name for the kind of physical and biological environment that would support these representative species. In other words, the PVT name could stand for the vegetation that would grow on a site at the first successional stage, the climax, or any stage in between.

Potential vegetation types were grouped into 15 *potential vegetation groups* (PVGs), based on similar general moisture or temperature environments. The 15 PVGs, along with the potential vegetation types that make up each group, are listed in Table 2-2.

PVGs provide a basis for discussion about vegetation change at the broad scale. They will be discussed in order from the highest elevation to the lowest elevation. Riparian potential vegetation groups are addressed in the Aquatic/ Riparian/Hydrologic section.

Agricultural, urban, water, and rock potential vegetation groups are not discussed in detail in this EIS because they are less related to or form extremely small components of BLM- or Forest Service-administered lands in the project area, or because they are not used as major vegetation divisions for discussions in Chapters 2 through 4.

Maps 2-5 and 2-6 present the historical and current distribution of PVGs in the project area. Table 2-3 displays the current distribution and amount of major potential vegetation groups in the project area.

Terrestrial Communities

The *Scientific Assessment* also classified vegetation by terrestrial community types and terrestrial community groups. Twenty-four terrestrial community types were developed by grouping the cover types by their broad-scale structural stages and common temperature, moisture, and elevation characteristics (Table 2-4). See definitions of cover type and structural stage in Key Terms and in further discussion below. The change in composition of these cover types, over time, also was evaluated in Hann, Jones, Karl, et al. (1997).

Some communities (riparian shrubland, riparian woodland, and riparian herbland) in the basin could not be accurately quantified at the broad scale, so they were not reported. Riparian terrestrial community types, for example, tend to occur in small- to medium-sized patches and are therefore better described and quantified at a mid or fine scale.

In forest settings, change was dominated by transition of early and late seral communities into mid seral communities. Changes in rangelands were dominated by transitions from upland herbland and shrubland communities into the agriculture type.

The analysis of terrestrial communities quantified changes from one terrestrial community to another, compositional changes for the basin and within ERUs (or RAC/PACs), and change in comparison to the historical range of the community. Terrestrial community type departures were determined by comparing current extent of each type to their modeled historical ranges. Most terrestrial communities show current areas that are outside of their median 75 percent historical range. In forest settings, only the early seral montane forest community occurs within its median historical range. Forest community change is dominated by the transitions of early and late seral communities into mid seral communities. Forest changes have been greatest in lower montane forest communities and least in subalpine forest communities (Hann, Jones, Karl, et al. 1997).

Three of the terrestrial community types described by Hann, Jones, Karl, et al. (1997)—agricultural, exotic herbland, and urban—are the result of recent human activity and were not described historically. The transitions of upland herbland and upland shrubland communities into the agricultural type dominates the changes in rangelands that have occurred in the basin from the historical to current periods. Agriculture is the third most dominant community type in the basin.

Ecologically significant trends are evident in seven terrestrial communities: upland herbland, upland shrubland, early seral lower montane forest, late seral lower montane single story forest, late seral lower montane single story forest, and late seral subalpine multi-story forest.

Both the early seral lower montane and late seral lower montane single story forest communities have declined by more than 75 percent. Early seral subalpine forests, mid seral lower montane forest, mid seral montane forest, late seral subalpine single story forest, and upland woodland have increased significantly. Trends in each of these communities across the basin are shown in Table 2-5.

The 24 terrestrial community types were later combined into 12 terrestrial community groups which, for some analyses, increased the comparability between the historical and current periods (Hann, Jones, Karl, et al. 1997).

Cover Type–Structural Stages

Wisdom et al. (in press) identified 91 species of birds, mammals, and reptiles of concern for analysis, based on broad-scale criteria. This information was drawn from the current status of habitats and/or populations of each species. The 91 species were clustered into 40 groups and further combined into 12 "families" on the basis of similar habitat requirements. See the Terrestrial Species section of this chapter for detailed discussion of Terrestrial Families.

Within each of the 12 Terrestrial Families, the species use a variety of types of vegetation called *source habitat*. The vegetation that makes up source habitats can be classified according to the dominant species or cover type, and the structural stage of that vegetation. An example of a cover type and structural stage would be a *ponderosa pine old forest single story structure*. The source habitats for the 12 Terrestrial Families contain many cover types and structural stages, with a different number of cover type–structural stage combinations for each Family. In total, the 91 terrestrial species in these 12 Families use 155 cover type–structural stage combinations.

The number of combinations for each family are:

Terrestrial Family	Number of Cover Type–Structural Stage Combinations
Family 1 (low elevation old forest)	15
Family 2 (broad elevation old forest)	86
Family 3 (forest mosaic)	123
Family 4 (early seral montane and lower montane)	11
Family 5 (forest and range mosaic)	143
Family 6 (forest, woodland, and montane shrubs)	85
Family 7 (forests, woodlands, and sagebrush)	133
Family 8 (rangeland and early and late seral forest)	27
Family 9 (woodlands)	7
Family 10 (range mosaic)	27
Family 11 (sagebrush)	20
Family 12 (grassland and open canopy sagebrush)	18

Cover type-structural stage combinations have either declined, remained fairly stable, or increased in geographic extent between the historical and current period in the project area. Those that have increased have often done so at the expense of those that have declined (Hann, Jones, Karl, et al. 1997). Individual cover type-structural stage combinations that have declined substantially from historical to current for the project area were identified by the EIS Team if the following three conditions were met:

1. A decline in geographic extent of 20 percent or greater between the historical and current periods in the project area (adapted from the cover type analyses in Hann, Jones, Karl, et al. 1997);
2. A decline in geographic extent from historical to current periods had to occur in at least 50 percent of the ERUs that were deemed by the EIS Team to have "management significance" (see criterion 3 for definition).
3. ERUs that were deemed of "management significance" had to have a change in geographic extent of the cover type-structural stage combination of at least 20 percent from the historical to current periods, unless the absolute change between historical and current was less than or equal to 0.05 percent of the ERU (adapted from the cover type analyses in Hann, Jones, Karl, et al. 1997).

Therefore, criterion 1 attaches a project-area-wide context, and criteria 2 and 3 attach an additional regional context to the identification of cover type-structural stage combinations that have declined substantially from historical to current. To be identified, the geographic extent of a cover type-structural stage combination had to show a substantial decline both in the project area as a whole, and within at least one-half of the regions (ERUs) where it is present.

Succession and Disturbance Processes

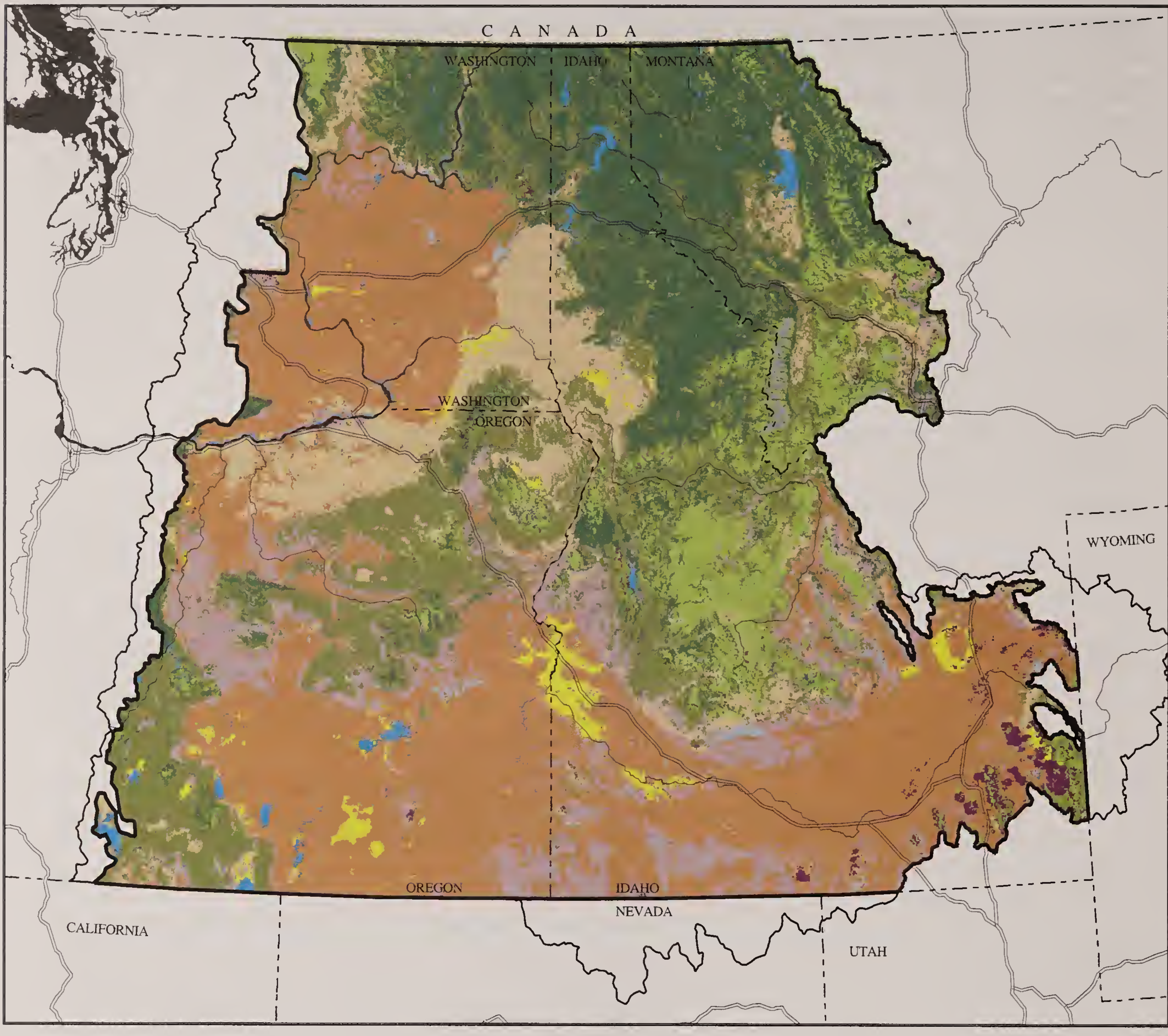
Some of the more important concepts of landscape dynamics to understand when reading this EIS are vegetation succession and disturbance processes, the events that cause disturbance, and the resulting vegetation patterns. Unless otherwise noted, the following information was derived from the Landscape Dynamics (Hann, Jones, Karl, et al. 1997) and Terrestrial Ecology (Marcot et al. 1997) chapters of the *Assessment of Ecosystem Components* (Quigley and Arbelbide 1997).

Table 2-2. Potential Vegetation Groups and Potential Vegetation Types in the Basin.

Potential Vegetation Group	Potential Vegetation Types
Alpine	Alpine shrub-herbaceous
Cold Forest	Mountain hemlock-Inland Spruce-fir, dry with aspen Spruce-fir, dry without aspen Spruce-fir, (whitebark pine greater than lodgepole pine) Spruce-fir, (lodgepole pine greater than whitebark pine) Whitebark pine/alpine larch-north Whitebark pine/alpine larch-south Mountain hemlock - East Cascades Mountain hemlock/Shasta red fir
Moist Forest	Cedar/hemlock-Inland Moist Douglas-fir Grand fir/white fir-Inland Spruce-fir, wet Cedar/hemlock - East Cascades Grand fir/white fir - East Cascades Pacific silver fir
Dry Forest	Dry Douglas-fir without ponderosa pine Dry Douglas-fir with ponderosa pine Dry grand fir/white fir Interior ponderosa pine Lodgepole pine - Oregon Lodgepole pine - Yellowstone Pacific ponderosa pine/Sierra mixed conifer
Woodland	Juniper Limber pine White oak Mountain mahogany Mountain mahogany with mountain big sage
Cool Shrub	Mountain big sage-mesic east Mountain big sage-mesic east with conifer Mountain big sage-mesic west Mountain big sage-mesic west with juniper Mountain shrub
Dry Grass	Agropyron steppe Fescue grassland Fescue grassland with conifer
Dry Shrub	Antelope bitterbrush Basin big sage steppe Low sage-mesic Low sage-mesic with juniper Low sage-xeric Low sage-xeric with juniper Big sage-warm Big sage-cool Salt desert shrub Threetip sage
Agriculture	Irrigated crop land Dry crop/pastureland
Riparian Herb	Riparian graminoid Riparian sedge
Riparian Shrub	Salix/carex Saltbrush riparian Mountain riparian low shrub
Riparian/Woodland	Cottonwood riverine Aspen
Urban	Urban
Rock	Barren of vegetation
Water	Water

The information in this table is for all lands in the entire basin, including the areas that were excluded from the decision space for the Supplemental Draft EIS (portions of Nevada, Utah, and Wyoming; and the area that overlaps with the Northwest Forest Plan area).

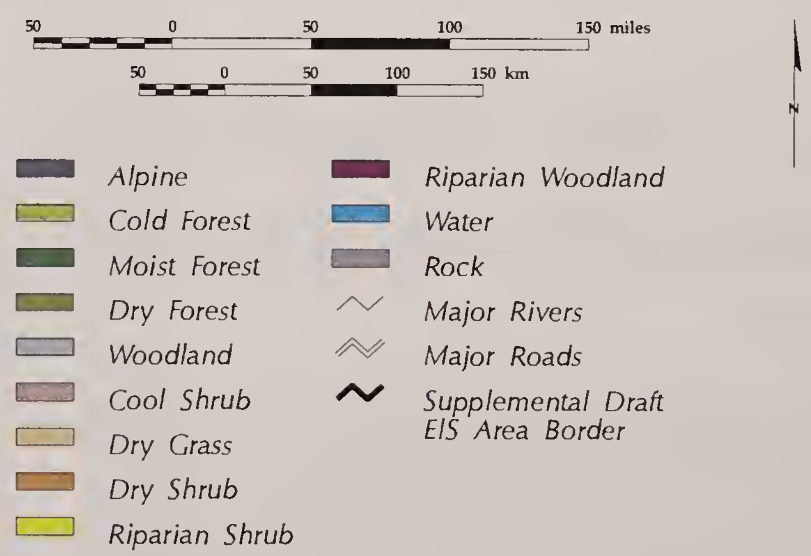
Source: Hann, Jones, Karl, et al. (1997).

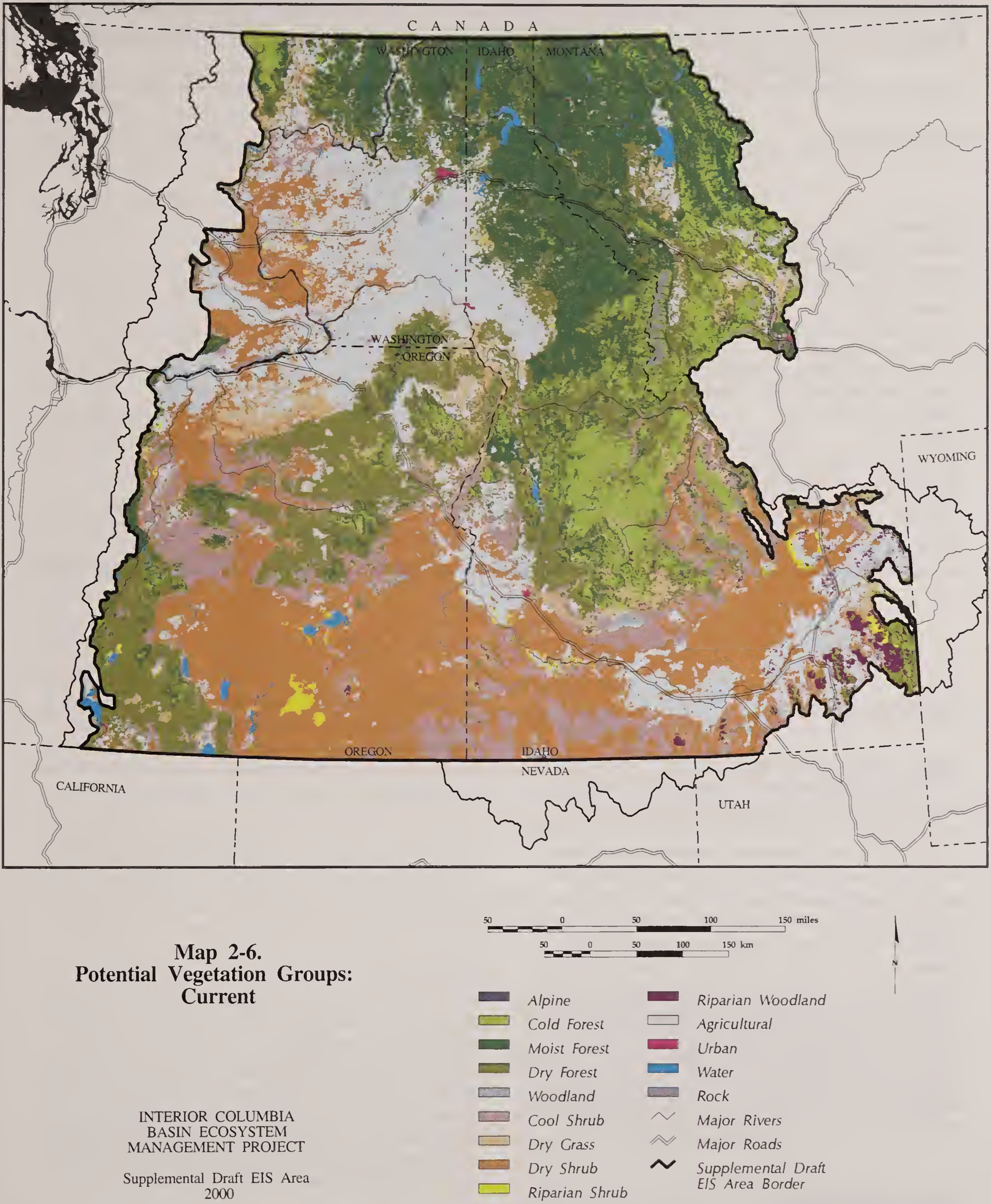


Map 2-5.
Potential Vegetation Groups: Historical

INTERIOR COLUMBIA BASIN ECOSYSTEM MANAGEMENT PROJECT

Supplemental Draft EIS Area
2000





**Map 2-6.
Potential Vegetation Groups:
Current**

INTERIOR COLUMBIA
BASIN ECOSYSTEM
MANAGEMENT PROJECT

Supplemental Draft EIS Area
2000

Table 2-3. Total Forest Service- and BLM-administered Acres by PVG Within Each RAC/PAC.

RAC/PAC Name	Cold Forest	Moist Forest	Dry Forest	Cool Shrub	Dry Grass	Dry Shrub
	Thousands of Acres					
Butte RAC	2,136	5,266	958	15	45	0.5
Deschutes PAC	64	262	750	786	43	540
Eastern Washington Cascades PAC	228	105	50	2	6	18
Eastern Washington RAC	119	1,158	212	10	19	71
John Day-Snake RAC	404	452	3,241	256	452	226
Klamath PAC	33	66	1,034	48	31	41
Lower Snake River RAC	296	266	536	1,675	291	2,885
Southeastern Oregon RAC	77	207	1,570	1,124	73	9,804
Upper Columbia-Salmon-Clearwater RAC-R1	848	4,822	1,042	1	75	2
Upper Columbia-Salmon-Clearwater RAC-R4	3,649	1,192	2,779	569	670	473
Upper Snake River RAC	578	32	598	1,367	434	4,306
Yakima PAC	0	4	0.2	5	2	30

Abbreviations used in this table:
BLM - Bureau of Land Management
PVG - potential vegetation group
RAC/PAC - Resource Advisory Council/Provincial Advisory Committee

Source: ICBEMP GIS data (converted to 1 km² raster data).

Succession

Plants respond to influences and disturbances from animals, people, and even other plant species by growing in patterns of succession. "Succession" refers to a predictable process of changes in structure and composition of plant and animal communities over time. Successional (or seral) stages often are described in terms of "early," "mid," or "late" to reflect the species and/or condition of vegetation and animal communities generally characteristic at different times during succession. Early seral communities, which occur early in the successional path, generally have less complex structural development than later successional communities. Late seral communities generally have mature, larger individuals (Hann, Jones, Karl, et al. 1997). Forest successional stages are presented in Table 2-6a. Rangeland successional stages are presented in Table 2-6b.

Disturbance

"Disturbance" refers to events that alter the structure, composition, and/or function of terrestrial or aquatic habitats. Disturbances in the native interior Columbia River Basin system generally follow cycles of infrequent, high intensity events (such as drought, floods, or crown fires) interspersed with frequent, low intensity events such as nonlethal underburns, annual wildlife grazing cycles, or scattered mortality from bark beetles (Hann, Jones, Karl, et al. 1997).

Succession and disturbance processes have changed considerably since settlement of the project area by immigrants from Europe and other places. The development of agriculture, mining, urban areas, transportation networks, and hydrologic projects, and other activities such as wildfire suppression, forest management, livestock management, and the introduction of exotic (non-native) plants and pathogens created a new set of disturbance regimes with which the native vegetation has not evolved. The result is altered succession and disturbance regimes which in turn affected the vegetative composition, structure, and patterns that appear on the landscape. These changes in the make-up of the vegetation then influence the survival and reproduction of aquatic and terrestrial species.

General forest and rangeland successional and disturbance processes are illustrated in Figures 2-9 and 2-10. Changes in fire disturbance severity and frequency from historical to current are shown on Maps 2-7 through 2-10.

Table 2-4. Terrestrial Community Types and Groups.

Terrestrial Community Group	Terrestrial Community Type
Agriculture	Agricultural
Alpine	Alpine
Exotic Herbland	Exotic Herbland
Lower Montane Forest[1]	Early Seral Lower Montane[1] Forest Mid Seral Lower Montane[1] Forest Late Seral Lower Montane[1] Multi-story Forest Late Seral Lower Montane[1] Single Story Forest
Montane Forest	Early Seral Montane Forest Mid Seral Montane Forest Late Seral Montane Multi-story Forest Late Seral Montane Single Story Forest
Rock	Rock/Barren
Subalpine Forest	Early Seral Subalpine Forest Mid Seral Subalpine Forest Late Seral Subalpine Multi-story Forest Late Seral Subalpine Single Story Forest
Upland Herbland	Upland Herbland
Upland Shrubland	Upland Shrubland
Upland Woodland	Upland Woodland
Urban	Urban
Water	Water
Not Used[2]	Riparian Herbland
Not Used[2]	Riparian Shrubland
Not Used[2]	Riparian Woodland

[1] Originally referred to as ponderosa pine forest.

[2] Patterns were not assessed for the riparian terrestrial community types because these types generally occurred in scattered, relatively small- to medium-sized patches, and tended to be underestimated as mapping resolution increased. Consequently, because the historical vegetation layer was developed at a coarser resolution than the current period vegetation layer, it was likely that the two mapping efforts contained different biases. Therefore, changes of riparian vegetation types between historical and current periods could not accurately be assessed.

Source: Adapted from Hann, Jones, Karl, et al. 1997, Table 3.9.

The most substantial change in vegetation in the basin was the ***conversion*** of 37 percent of non-BLM- or Forest Service-administered land to agricultural use, much of which is dominated by exotic plants. Only one percent of the basin was converted to urban areas, but the impact of the huge increase in human population that lives there and their impact on the natural resources of the basin go far beyond the urban boundaries.

The introduction of ***exotic plants*** resulted in the replacement of native cover types and structures especially in the dry grass, dry shrub, cool shrub, and riparian potential vegetation groups (PVGs). (See the Landscape: Terrestrial Upland Environment section of this chapter for a complete discussion of vegetation classifications, including PVGs.) Although these shade-intolerant exotic plants invaded the forested PVGs, they typically did not displace the dominant species. The agricultural PVG showed the greatest susceptibility to invasion by exotic plants, while the alpine PVG was least susceptible.

White pine blister rust, an introduced pathogen that attacks western white pine and whitebark pine, has modified cover types, structures, and successional pathways within moist and cold PVGs. Approximately 19 percent of Forest Service- and BLM-administered lands in the basin have been changed by white pine blister rust (Hann, Jones, Karl, et al. 1997).

Table 2-5. Changes in Extent of Terrestrial Communities, Within the Basin, Historical to Current Periods.

Cover Type	Historical Area[1]	Current Area[2]	Class Change[3]	Basin Change[4]
		Percent		
Agricultural	0.00	16.06	NA[5]	16.06[6]
Alpine	0.16	0.16	-0.18	0.00
Early Seral Lower Montane Forest	1.10	0.26	-76.75[6]	-0.85
Early Seral Montane Forest	8.67	7.94	-8.40	-0.73
Early Seral Subalpine Forest	1.21	1.80	48.20[6]	0.58
Exotic Herbland	0.00	2.06	NA[5]	2.06[6]
Late Seral Lower Montane Multi-story Forest	2.16	1.42	-34.55[6]	-0.75
Late Seral Lower Montane Single Story Forest	5.56	1.08	-80.61[6]	-4.48[6]
Late Seral Montane Multi-story Forest	3.80	3.38	-11.18	-0.43
Late Seral Montane Single Story Forest	0.78	0.85	8.38	0.07
Late Seral Subalpine Multi-story Forest	1.23	0.45	-63.83[6]	-0.79
Late Seral Subalpine Single Story Forest	0.57	0.78	36.32[6]	0.21
Mid Seral Lower Montane Forest	4.91	7.52	53.03[6]	2.60[6]
Mid Seral Montane Forest	10.48	16.62	58.58[6]	6.14[6]
Mid Seral Subalpine Forest	2.72	2.70	-1.02	-0.03
Rock/Barren	0.24	0.24	0.00	0.00
Upland Herbland	14.88	4.94	-66.82[6]	-9.94[6]
Upland Shrubland	36.71	25.50	-30.53[6]	-11.21[6]
Upland Woodland	1.91	2.85	49.49[6]	0.94
Urban	0.00	0.16	NA[5]	0.16
Water	0.94	0.94	0.00	0.00

The information in this table is for all lands in the entire basin, including the areas that were excluded from the decision space for the Supplemental Draft EIS (portions of Nevada, Utah, and Wyoming; and the area that overlaps with the Northwest Forest Plan area).

[1] Historical area - circa 1850 to 1900 (initiated model simulation).
[2] Current Area - circa 1991.
[3] Class change - percent change relative to the terrestrial community.
[4] Basin change - percent change of the basin attributable to the terrestrial community change.
[5] NA - Not applicable; the terrestrial community did not exist during the historical period.
[6] Ecologically significant changes.

Source: Adapted from Hann, Jones, Karl, et al. 1997, Table 3.139.

Excessive livestock grazing pressure on rangelands in the late 1800s and early 1900s caused excessive soil losses from upland habitats. In combination with the agriculture and loss of beavers, livestock grazing lowered the water table in valley bottom habitats and greatly reduced the extent of riparian shrubland and riparian woodland PVGs.

Dams across rivers and streams were built to generate power, irrigate agricultural land, and provide flood control. The impacts on the landscape carried far beyond the stream banks where migrating fish found the dams to be impediments. The reduction in some populations and extinction of others eliminated a food source that many aquatic and terrestrial species depended on for survival in the nutrient-poor mountains of the interior Columbia Basin. The reduction in the annual pulse of nutrients anadromous fish bring from the coastal estuaries into the streams, lakes, and uplands of the basin has affected both aquatic and terrestrial habitats.

Traditional timber harvest methods often changed the species composition and/or the stand structure in forested PVGs. By harvesting the large dominant shade-intolerant trees and leaving the shade-tolerant trees, forests have been quickly converted from late seral shade-intolerant forests to mid seral shade-tolerant forests. Clearcut logging changed mid or late seral forests to early seral forests.

For additional discussion of how these and other change factors have influenced forests, rangelands, aquatic systems, terrestrial and aquatic species, and

human elements of the ecosystem, see the Factors of Influence section at the end of this chapter.

General Succession and Disturbance Regime Patterns

Forestlands

Historically, *foothill and mountainous terrain* dominated by forest potential vegetation groups had consistent patterns of succession/disturbance regimes which resulted in characteristic vegetation patterns on the landscape (see Figure 2-11). This is referred to as the native system. Over the past century, there have been two general strategies of land management: (1) traditional commodity production; and (2) traditional reserve management. As a general rule in traditional forest commodity production, roads have been built, timber has been harvested, and fires have been suppressed. This has taken place in many of the accessible areas, especially those that supported large trees. Traditional reserve management such as wilderness, generally involved more of a passive approach to management, although wildfires were still suppressed. Traditional reserves often have been associated with more remote and less productive areas. Traditional commodity production and traditional reserve management coupled with wildfire suppression have substantially changed the patterns of succession, disturbance, and vegetation. Like the native system, these patterns are generally predictable. (See Figures 3.11b and 3.11c, in Hann, Jones, Karl, et al. [1997]).

The dominant disturbances affecting succession in the native system were wildfire, insects, disease, weather (wind), and floods. Typically, *ridges, plains, and terraces* supported late seral single story forests (for example, open, park-like stands of ponderosa pine) sustained by frequent fires and other nonlethal disturbances (5- to 25-year disturbance interval) that killed understory trees. The composition and structure of

Table 2-6a. Forest Structural Stages.

	Structural Stage	Definition	In this EIS, Also Called Seral Stage
	Stand-initiation	When land is reoccupied following a stand-replacing disturbance.	Early Successional Regenerational Early Seral
	Stem exclusion - open canopy	Forested areas where the occurrence of new tree stems is limited by moisture.	Mid Successional Young Forest (managed & unmanaged) Mid Seral
	Stem exclusion - closed canopy	Forested areas where the occurrence of new tree stems is predominantly limited by light.	
	Understory reinitiation	When a second generation is established under an older, typically early seral, overstory.	
	Young forest multi-story	Stand development resulting from frequent harvest or lethal disturbance to the overstory.	
	Old multi-story	Forested areas lacking frequent disturbance to understory vegetation.	Late Successional Mature and Old Forest Multi-story Late Seral
	Old single story	Forested areas resulting from frequent nonlethal natural or prescribed underburning or other management.	Late Successional Mature and Old Forest Single Story Late Seral

Table 2-6b. Rangeland Structural Stages.

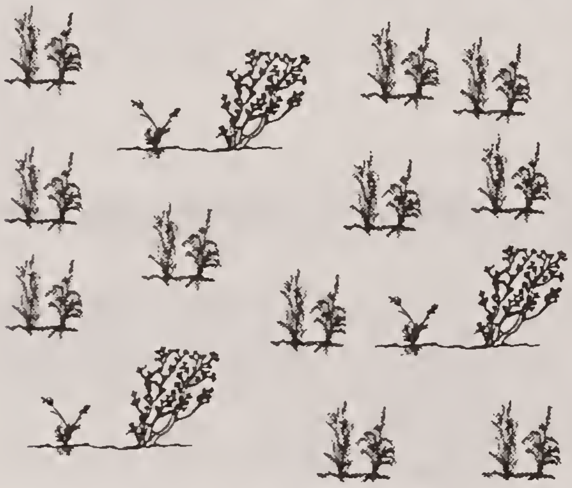
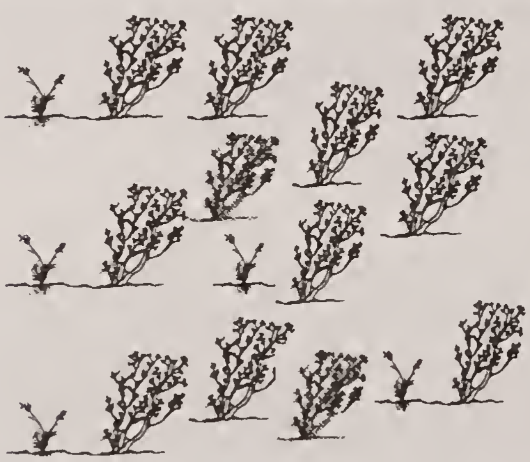
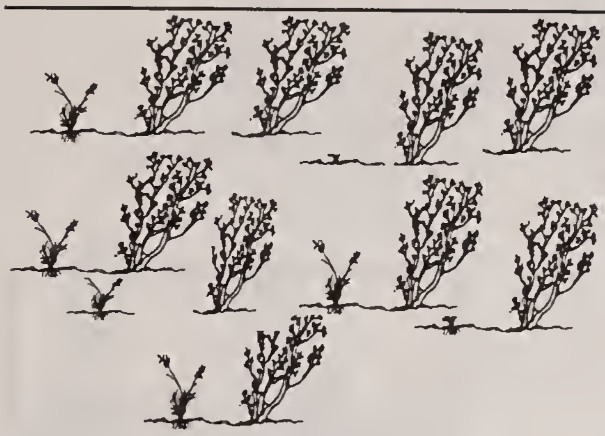
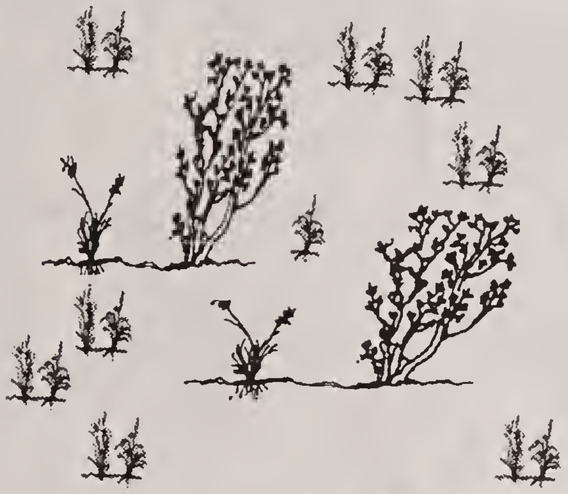
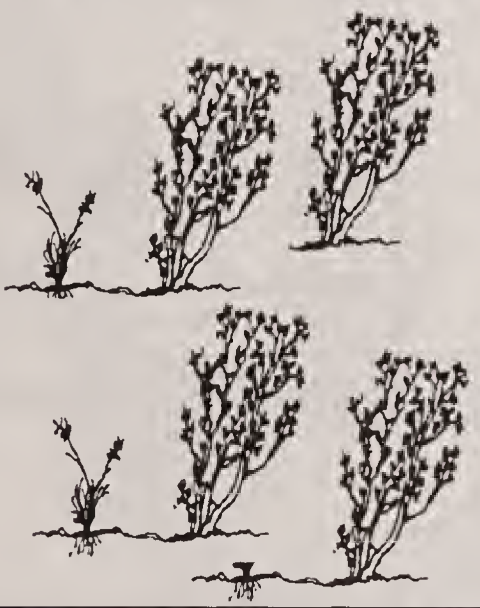
	Structural Stage	Definition
	Open Herbland	Area has less than 15% canopy cover[1] of herbaceous species[2] and less than 5% canopy cover of trees and shrubs. (Typical setting is less than 12" precipitation or rocky environment.)
	Closed Herbland	Area has 15% or greater herbaceous species and less than 5% canopy cover of trees and shrubs. (Typical setting is greater than 12" precipitation and good soil; may occur after fire in a shrub type.)
	Open Low Shrub	Area has less than 15% canopy cover of low (<20") shrubs (for example, black sagebrush) and less than 5% canopy cover of trees. (Typical setting is less than 12" precipitation and lithic or rocky environment.)
	Closed Low Shrub	Areas has 15% or greater canopy cover of low (<20") shrubs (for example, black sage-brush) and less than 5% canopy cover of trees. (Typical setting is less than 12" precipitation and lithic or rocky environment; usually a result of fire exclusion.)
	Open Mid Shrub	Area has less than 15% canopy cover of mid (>20" to <6.5') shrubs (for example, Wyoming sagebrush) and less than 5% canopy cover of trees. (Typical setting is upland bench or foothill environment.)

Table 2-6b. Rangeland Structural Stages. (continued)

	Structural Stage	Definition
	Closed Mid Shrub	Area has 15% or greater canopy cover of mid (>20" to <6.5') shrubs (for example, Wyoming sagebrush) and less than 5% canopy cover of trees. (Typical setting is upland bench or foothill environment; usually a result of fire exclusion.)
	Open Tall Shrub	Area has less than 15% canopy cover of tall (>6.5') shrubs (for example, chokecherry) and less than 5% canopy cover of trees. (Typical setting is draw or swale upland environment.)
	Closed Tall Shrub	Area has 15% or greater canopy cover of tall (>6.5') shrubs (for example, chokecherry) and less than 5% canopy cover of trees. (Typical setting is valley broad riparian zone or wetland environment.)

[1] Canopy cover for this definition is on-the-ground cover at a 1:1 scale. This typically is measured by a line-intercept technique for shrubs, or by a quadrad microplot for herbaceous plants. Canopy cover can also be estimated if these techniques are used for calibration. This is the technique and scale normally used by Forest Service and BLM field staff at the fine scale, but it differs from the definition and measurement technique reported in Hann, Jones, Karl et al. (1997; Appendix 3-G, p. 1007) and in Hessburg et al. (in press). That technique used photo interpretation methods at a scale of approximately 1:12,000, which is not applicable for the fine-scale techniques used by the agencies on the ground.

A comparison of the two techniques and scales (1:1 versus 1:12,0000) reveals a ratio of approximately 1:4; that is, canopy cover thresholds using the photo interpretation/1:12,000 scale will be about 4 times higher than canopy cover thresholds using the line intercept/1:1 scale (S. Bunting, University of Idaho Range Science Department, pers. comm. with W. Hann 1997). For example, a 15 percent canopy cover of shrubs using line intercept at a 1:1 on-the-ground scale will be comparable to a 60 to 70 percent canopy cover using photo interpretation dot-grid techniques at a 1:12,000 scale.

This table uses the definition for canopy cover that is consistent with the technique and scale used by the Forest Service and BLM at the fine scale.

[2] Herbaceous species are vascular plants with non-woody stems, such as grasses and forbs.

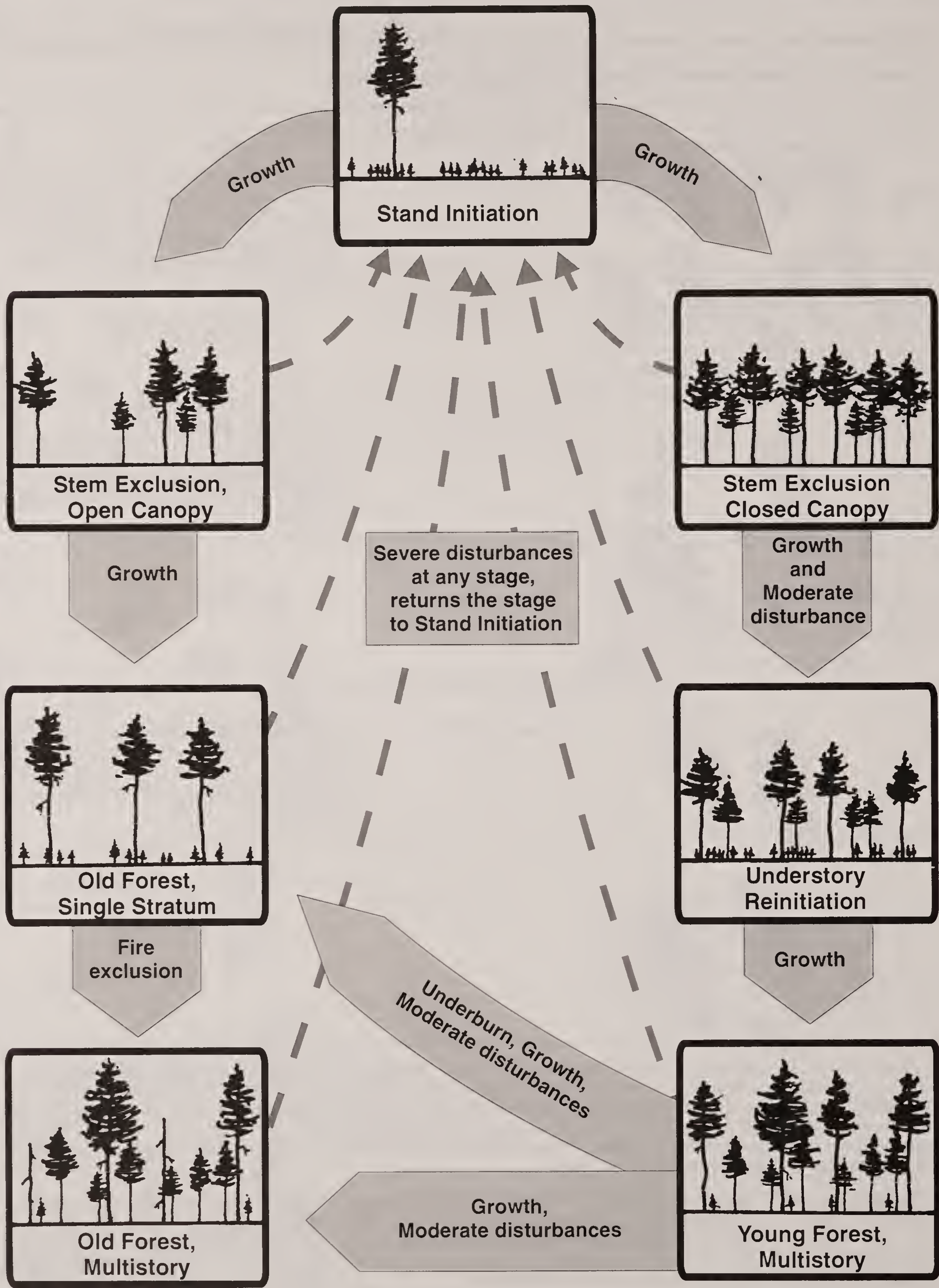


Figure 2-9. General Forest Successional and Disturbance Processes.

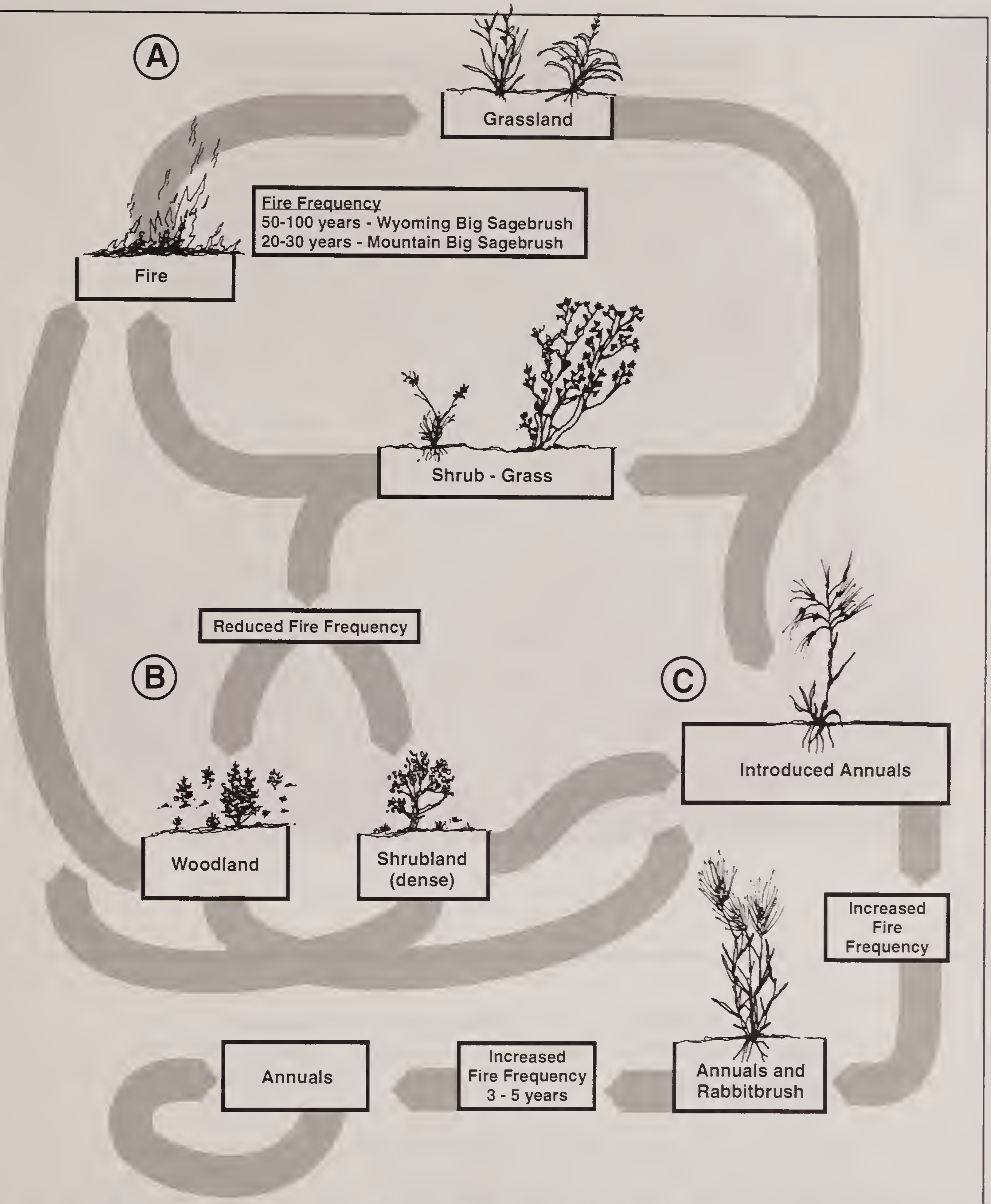
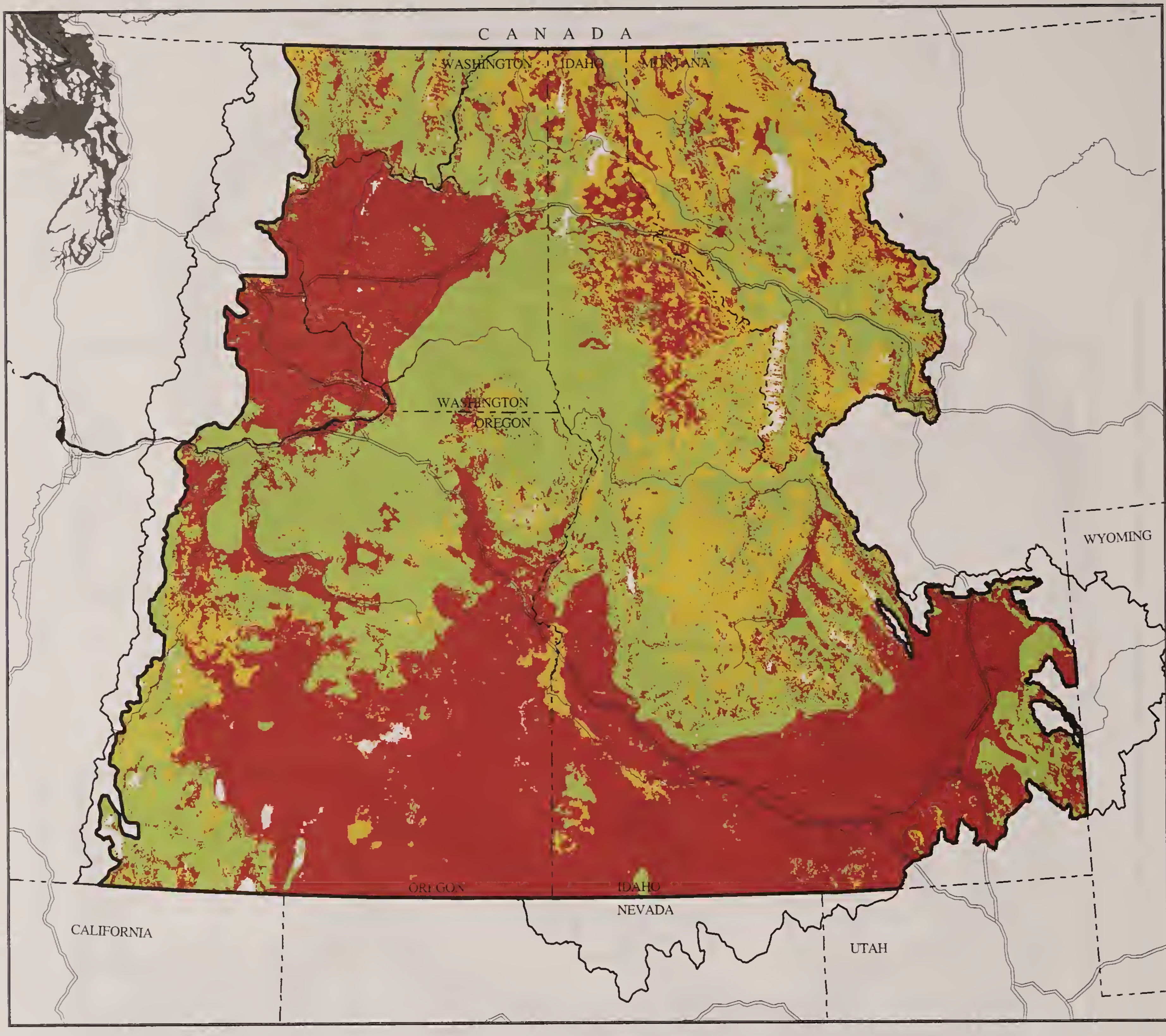


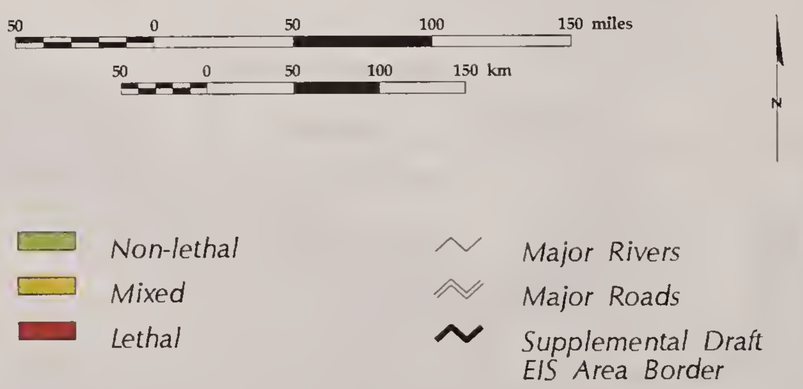
Figure 2-10. General Rangeland Successional and Disturbance Processes (includes altered sagebrush steppe). Three common pathways of succession in the sagebrush steppe. Pathway A represents a succession from a grassland to a shrub-grass dominated plant community, with fire acting to move the shrub-grass community back to a grassland. This type of succession follows the "Climax Model" of plant succession. Pathway B represents succession of a shrub-grass dominated plant community to either a woodland (dominated mostly by juniper) or a shrubland, caused by a reduction in fire occurrence. The dense shrub or woodland plant community can re-enter Pathway A if native perennial understory plants are sufficient to establish themselves following a wildfire or it could move into Pathway C if the understory plants are mostly introduced annuals such as cheatgrass following a wildfire. Pathway C represents succession of a shrub-grass or woodland-shrub-grass dominated plant community to a community dominated by introduced annual grasses, characterized by an increase in fire occurrence. Once dominated by introduced annual grasses, the community tends to remain this way because of frequent fire and competition from the introduced annual grasses which prevents shrubs and native perennial grasses from establishing. This type of succession follows the "State and Transition Model" of plant succession. (Adapted from Vavra et al. (editors) 1994.)

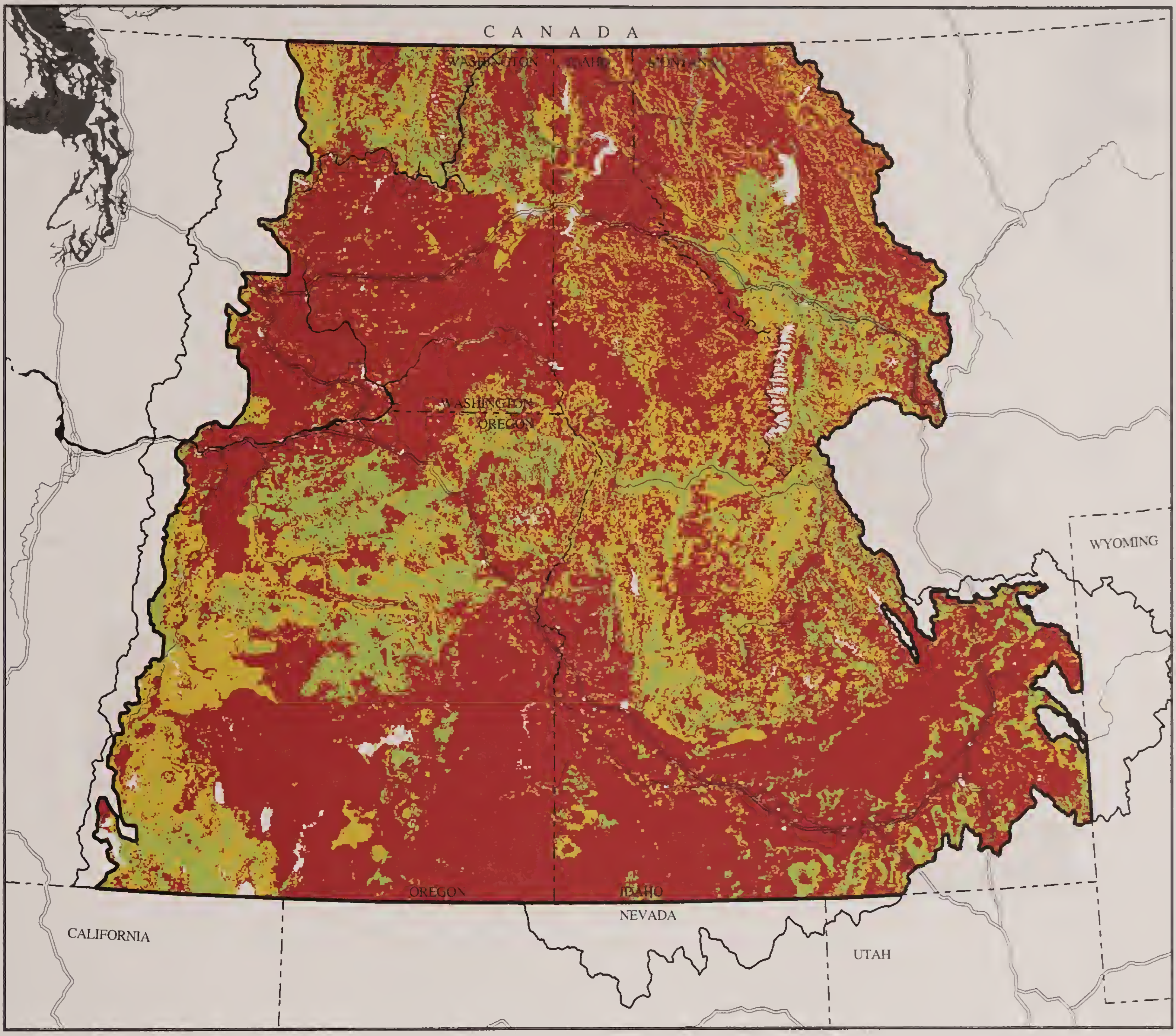


Map 2-7.
Fire Regime Severity: Historical

INTERIOR COLUMBIA
BASIN ECOSYSTEM
MANAGEMENT PROJECT

Supplemental Draft EIS Area
2000





50 0 50 100 150 miles

50 0 50 100 150 km

N

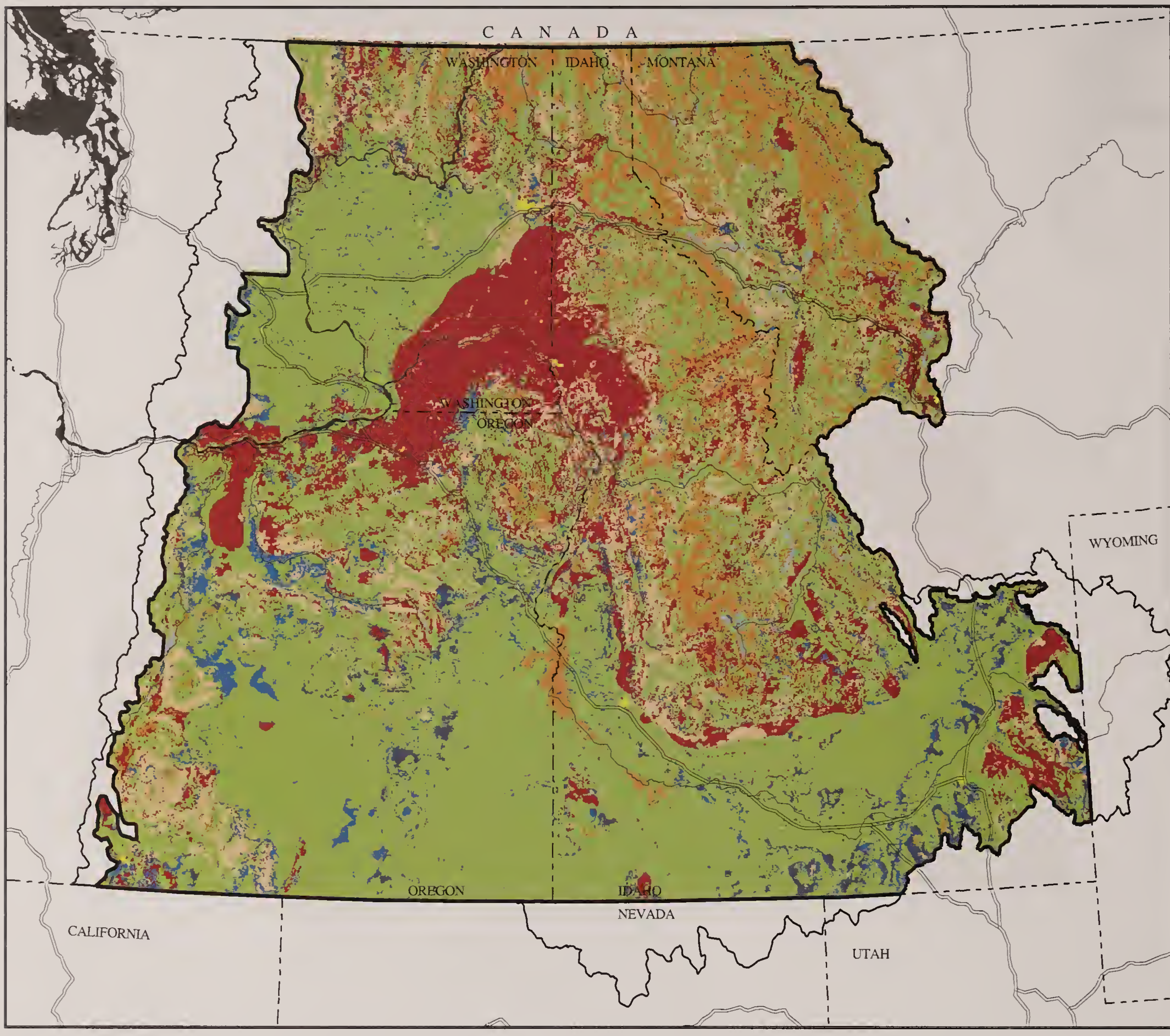
Map 2-8.
Fire Regime Severity: Current

Non-lethal
Mixed
Lethal

Major Rivers
Major Roads
Supplemental Draft EIS Area Border

INTERIOR COLUMBIA
BASIN ECOSYSTEM
MANAGEMENT PROJECT

Supplemental Draft EIS Area
2000



50 0 50 100 150 miles

50 0 50 100 150 km

N

Map 2-9.
Changes in Fire Regime Severity: Historical to Current

INTERIOR COLUMBIA BASIN ECOSYSTEM MANAGEMENT PROJECT

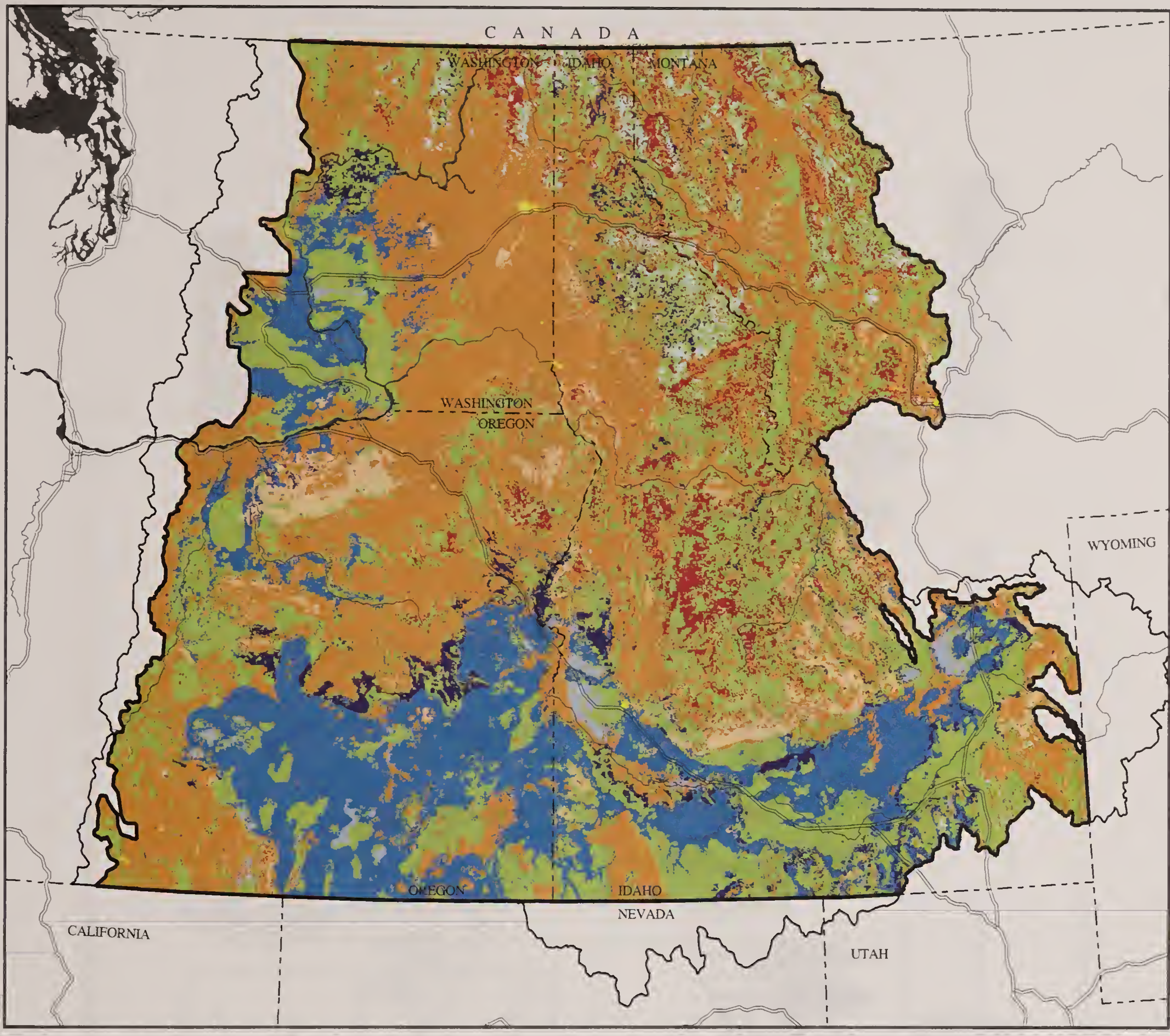
Supplemental Draft EIS Area
2000

More Lethal:
- *Non-Lethal to Lethal*
- *Mixed to Lethal*
- *Non-Lethal to Mixed*

Less Lethal:
- *Lethal to Non-Lethal*
- *Lethal to Mixed*
- *Mixed to Non-Lethal*
- *Any Severity Class to Rarely Burns*

No Change:
- *No Change*

Major Rivers
Major Roads
Supplemental Draft EIS Area Border



Map 2-10.
Changes in Fire Regime Frequency: Historical to Current

INTERIOR COLUMBIA BASIN ECOSYSTEM MANAGEMENT PROJECT

Supplemental Draft EIS Area
2000

Less Frequent:
- 0-150 to 151-300 or 300+ MFI
- 0-75 to 75-150 MFI
- 0-25 to 26-75 MFI
- Any Frequency Class to Rarely Burns

More Frequent:
- 76-300 to 26-75 MFI
- 26-150 to 0-25 MFI
- 300+ to 26-75 or 76-150 MFI
- 151-300 to 76-150 MFI

No Change:
- No Change

MFI = Mean Fire Interval (years)

Major Rivers
Major Roads
Supplemental Draft EIS Area Border

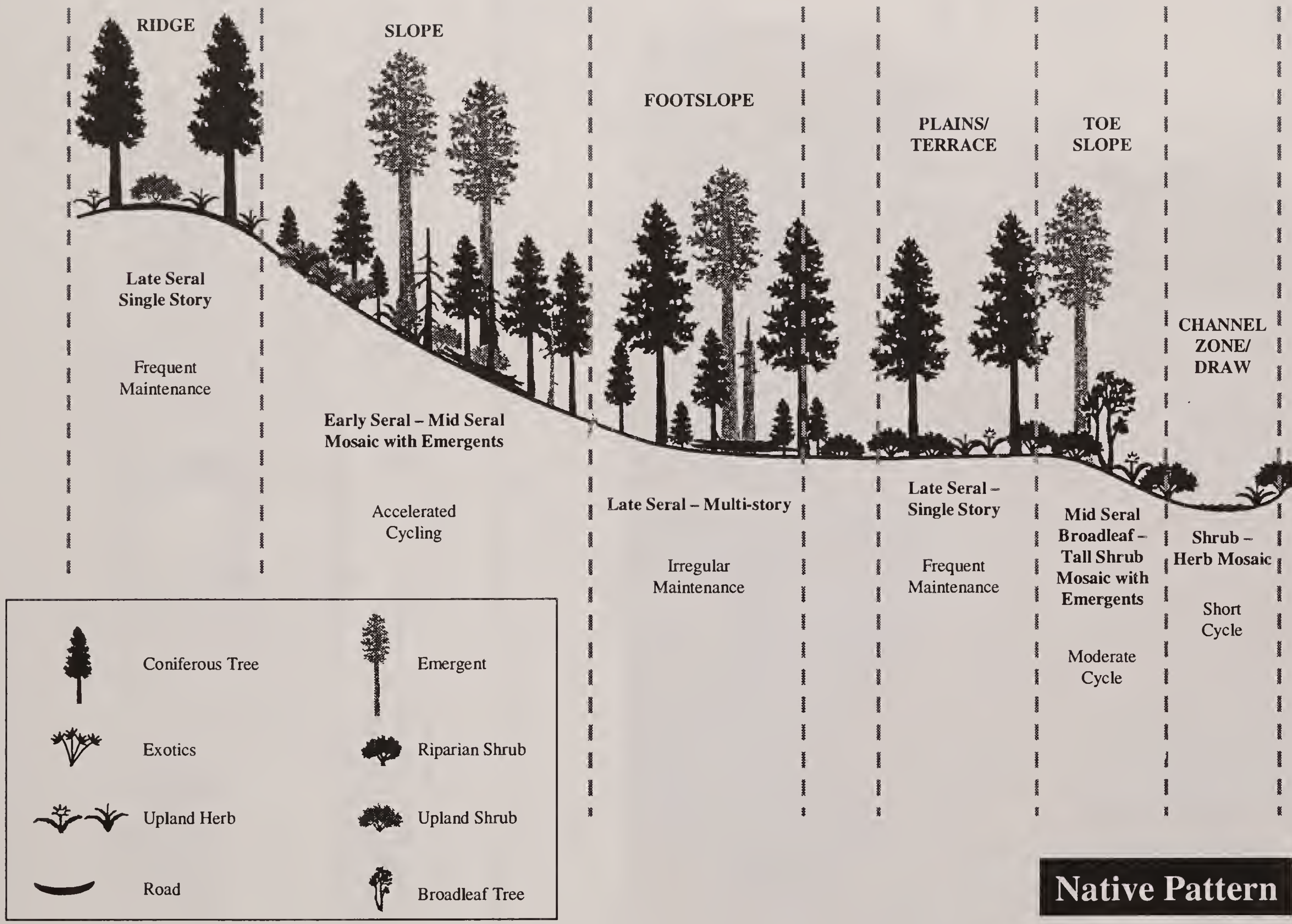


Figure 2-11. Forest Landscape Patterns—Succession/Disturbance Regime Patterns on the Landscape. Source: Hann, Jones, Karl, et al. 1997.

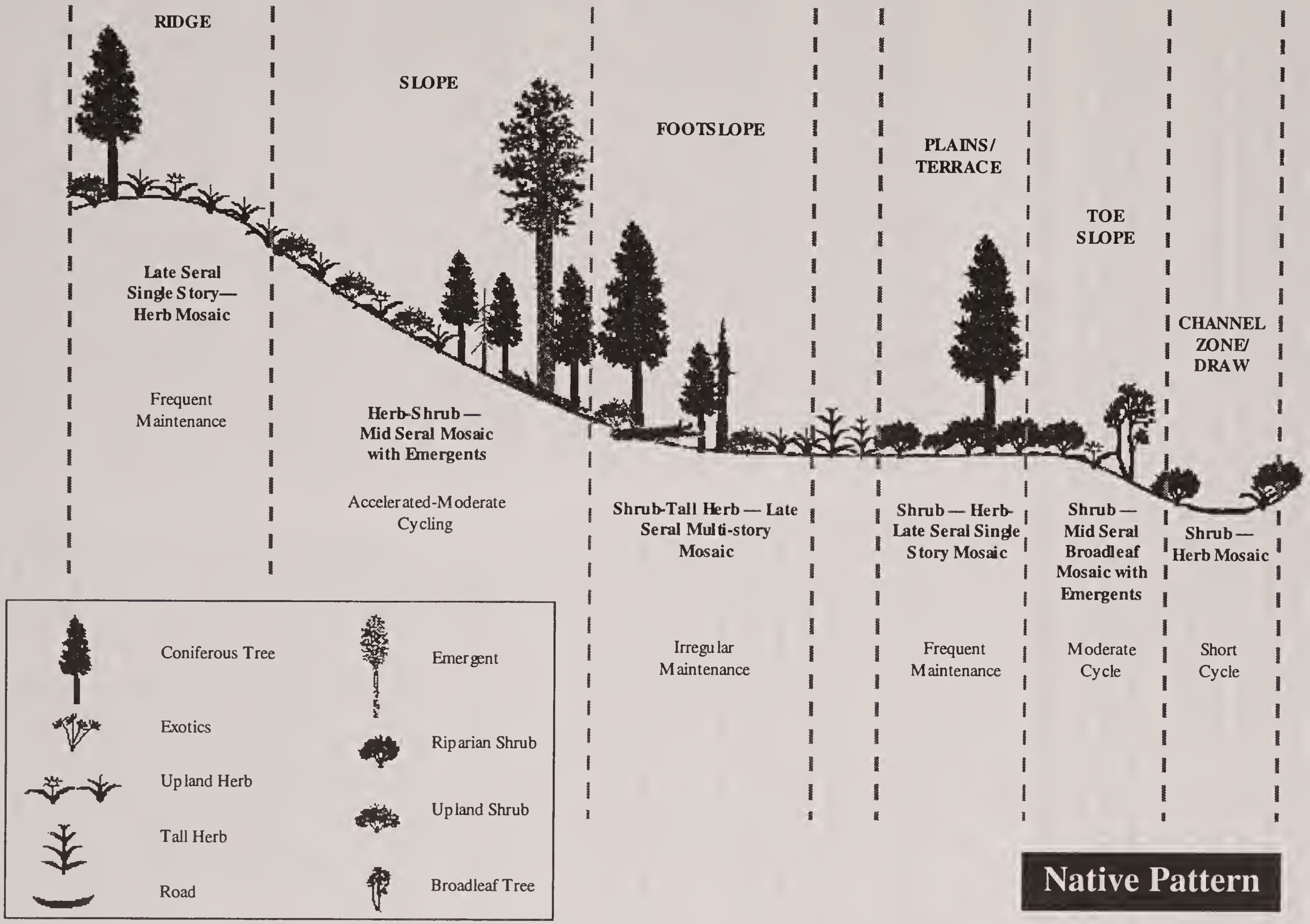


Figure 2-12. Rangeland Landscape Patterns—Succession/Disturbance Regime Patterns on the Landscape.

Forest Health - A Definition

'Forest health' is defined as the condition in which forest ecosystems sustain sufficient complexity, diversity, resiliency, and productivity to provide for specified human needs and values. It is a useful way to communicate about the current condition of the forest, especially with regard to resiliency, a part of forest health which describes the ability of the ecosystem to respond to disturbances. Resiliency is one of the properties that enable the system to persist in many different states or successional stages. Forest health and resiliency can be described, in part, by species composition, density, and structure.

Forests are constantly changing through a combination of disturbances, such as fire, climate, insects, disease, timber harvest, and grazing. Change determines the plant and animal species that will exist in forested areas, and governs future products, recreational opportunities, habitats, and other resources provided by forests.

these forests were generally maintained over the long term. The most drastic changes have occurred in these areas.

Traditional commodity management typically removed large trees from ridges and terraces and moved the forest from late seral to mid or early seral stages of development. The disturbance regime also took a major shift from nonlethal with a return interval of 100 to 300 years or more to lethal with a return interval of 10 to 50 years. In areas with traditional reserve management landscape patterns, the open late seral single story forests changed to relatively dense late seral multi-story forests with or without large trees, depending on the intensity of insects, disease, or drought stress.

Historically on slopes, especially ***steep slopes***, could be found mid seral forest mosaics that included some late seral and some early seral patches. A common stand characteristic was emergent trees, or remnants from previous stands. The predominant disturbance regime included a mixture of nonlethal and lethal fires and other disturbances. The nonlethal fire return interval ranged from 5 to 50 years. On these slopes, wildfire could carry into the crowns and become a lethal fire every 30 to 300 years. The wildfire scenario varied by location on the landscape, aspect, and potential vegetation group.

On the slopes, traditional forestry and fire management has resulted in the loss of large shade-intolerant emergent trees and fostered the development of dense mid seral forests. Traditional reserve management has resulted in very similar species composition and structure to that of traditional forestry and fire management. The main difference is that reserve areas may maintain emergent trees until the first cycle of disturbance. The lethal disturbance regime that has evolved interjects wildfire, insects, or disease into the forest every 10 to 50 years, causing a high risk for lethal crown fires. Without human intervention, periods of regeneration tend to be very long because of a lack of seed source.

Historically, late seral multi-story forests lived on the ***footslopes***, maintained by nonlethal fires at intervals of 25 to 50 years. This fire return interval was longer than on the ridges and terraces and allowed more layers in the canopy and more shade-tolerant species to survive. Before Euroamerican settlement, footslopes often supported large trees and large timber volumes.

In traditional commodity management, the footslopes gave good accessibility to large volumes of timber and lent themselves to road building. The traditional commodity regime removed the overstory, exposing trees to frost, high water tables, and sunlight, and changing the disturbance regime to a lethal one with return intervals generally greater than 300 years with high severity. Traditional reserve management also changed the disturbance regime to a lethal one, but the return interval is 10 to 50 years and the severity is low.

Toeslopes refers to areas where upland vegetation meets riparian vegetation. Typically, on the toeslopes would be found some combination of mid seral broadleaf trees (cottonwood, aspen) and tall shrub mosaics with some scattered emergent conifers. This condition was probably recycled by a lethal fire every 5 to 100 years. The ***channel zone/draw*** supports a shrub-herb mosaic that includes the stream channel. The annual high water was the major disturbance on these parts of the landscape.

Both traditional commodity and reserve management scenarios have led the toeslopes and the channel

zone/draw to more mid seral and late seral stages with multi-story structure and a heavier build-up of fuel. The traditional commodity scenario has in many cases also caused a lowering of the water table. Under both commodity and reserve management, the toeslope and channel zone/draw disturbance regime has changed to lethal, and highly severe in nature. The return interval for traditional commodity is in the range of 100 to 300 years, while under the traditional reserve the disturbance return rate is a shorter 10 to 50 years. In the channel zone/draw under both scenarios, the disturbance regime is lethal and the return interval is a highly variable 5 to 100 years with moderate severity.

Rangelands

As in forestland potential vegetation groups, areas in native *basin and foothill terrain* that were dominated by rangeland potential vegetation groups had consistent patterns of succession and disturbance which resulted in vegetation patterns on the landscape. This is referred to as the native system (see Figure 2-12). Over the past century, there have been two general strategies of land management: (1) traditional commodity production; and (2) traditional reserve management. As a general rule in rangeland commodity production, livestock has been grazed, fires have been suppressed, and exotic plants have been introduced. Even in areas of traditional reserve management, such as wilderness areas, there has been wildfire suppression and introduction of exotic plants. Both traditional commodity production and traditional reserve management have substantially changed the patterns of succession, disturbance, and vegetation. Like the native system, these patterns are generally predictable. (See Figures 3.12b and 3.12c in Hann, Jones, Karl, et al. [1997]).

The *ridges, terraces and plains* historically had a succession and disturbance regime that supported herb-dominated grassland, with a diversity of upland grasses, sedges, forbs, and scattered shrubs. Scattered large conifers such as ponderosa pine, Douglas-fir, or juniper were found on ridges or rocky outcrops. Intervals of disturbances vary between infrequent and lethal events (5 to 100 years) in colder or drier environments to more frequent (5 to 50 years) nonlethal regimes in warmer and moister environments. Traditional commodity management on ridges, terraces, and plains changed disturbance regime to mostly lethal with a 100- to 300-year interval and a high intensity. Consequently, the herb-dominated communities were replaced by conifer communities or dense decadent shrubs. Because of a lack of fine grass fuels, these sites burn only during very dry conditions. High livestock use during the growing season coupled with fire suppression has changed the disturbance from nonlethal to lethal, with a return interval of 10 to 50 years and a low severity. In turn, the overall density of large grasses has decreased and the dominance of smaller grasses has increased.

High livestock use during the growing season coupled with fire suppression has changed the disturbance from nonlethal to lethal, with a return interval of 10 to 50 years and a low severity.

Slope landforms usually support a lethal disturbance regime ranging from 5 to 100 years. The vegetation that resulted was a shifting mosaic of shrub and herb communities. Shrub-dominated communities were typically open and relatively young and vigorous, with a diversity of understory grasses. Herb-dominated patches contained grasses, sedges, and scattered shrubs as well. Shrub patches were commonly associated with rises or rocky areas that likely had nonlethal disturbances, while herb patches were associated with concave areas that had a higher probability of lethal fire.

The response of slope landforms to traditional commodity management followed one of several pathways depending on the presence of exotic plants:

1. If exotic species did not dominate a substantial portion of the site, the disturbance regime changed to 100- to 300-year, lethal, high severity regime.
2. If exotic herbs dominate the site, the disturbance regime likely has changed to a low severity lethal regime on a 10- to 50-year cycle. These sites are susceptible to soil erosion.
3. If the slope is dominated by exotic grasses, the disturbance regime has probably changed to a frequent (1- to 4-year) lethal regime with high severity.
4. On sloped sites lacking exotic species, the disturbance regime did not change much but became less severe because of a reduction in fine fuels. The dominance of shrubs has increased on these sites and conifers have encroached into areas with higher precipitation.

Footslope landforms had a nonlethal disturbance regime with a return interval of 5 to 50 years. Footslopes were typically dominated by herb communities with large grasses and forbs. Small patches of broadleaf trees were grouped around springs and

seeps. High grazing pressure during the growing season has converted predominant disturbance regime on rangeland footslopes to a lethal one with a cycle of 10 to 50 years. The large grasses and forbs have been replaced by smaller species more characteristic of the rangeland slopes.

In the ***toeslopes***, flood or fire at 5- to 100-year cycles occurred with lethal intensity. In general, shrub–herb communities dominated sites with coarse textured soils, and shrub or mid seral broadleaf trees dominated sites with heavier soils. ***Channel zone/draw*** landforms have a 1- to 4-year lethal disturbance regime and support scattered shrubs and herbs. Great changes have taken place in the toeslopes and channel zone/draw landforms. The disturbance regime has been shortened to 10- to 50-year return intervals. The multiple layers of broadleaf trees or shrubs have been reduced to a single layer of broadleaf trees or shrubs with an herbaceous understory.

Forestlands/Rangelands

Areas in foothill and mountainous terrain with both forest and rangeland vegetation have inherently diverse community structure and vegetation patterns (see Figure 3.13a, in Hann, Jones, Karl, et al. 1997). In addition, this unique terrain is home to many complex relationships at the ecotones, or boundaries between adjacent communities. The traditional commodity management scenario—with its timber harvest, livestock management, introduction of exotic plants, wildfire suppression, and consequent introduction of white pine blister rust—substantially changed the succession/disturbance regimes as well as the associated vegetation patterns, composition, and structures (see Figure 3.12b, in Hann, Jones, Karl, et al. 1997). In general, the disturbances became less frequent and more intense, and the effects became more severe. Changes were more substantial in the forest/rangeland transition zone than either the forest or rangeland because their energy gradients were much steeper, their disturbance regimes were more dynamic, and species diversity was higher. The traditional reserve or semi-primitive management scenario in conjunction with fire exclusion, introduction of white pine blister rust, and introduction of exotic plants, also substantially changed the succession/disturbance regimes and the vegetation patterns, composition, and structures (see Figure 3.12c, in Hann, Jones, Karl, et al. 1997).

Typically, changes due to traditional commodity management result in longer intervals between disturbances and an increase in the area affected by those disturbances. Traditional reserve management similarly caused longer disturbance return intervals and more severe disturbances than the native pattern.

Project area mountains, forests, and streams support diverse plant and animal populations offer unparalleled recreational, cultural, and economic opportunities to people.

Alpine Potential Vegetation Group

Alpine Potential Vegetation Types (PVTs):

Alpine shrub-herbaceous

Background

Most (83 percent) of the alpine potential vegetation group is located on BLM- or Forest Service-administered lands. For the project area as a whole, the alpine PVG covered a very small portion (less than 0.5 percent) historically, and did not change substantially in geographic extent between historical and current.

Table 2-7 lists the composition and structure of vegetation within the alpine potential vegetation group.

Current Conditions and Trends

At the broad scale, fire frequency and severity in alpine vegetation did not change from historical to current. Thus, broad-scale vegetation and disturbance patterns did not provide much evidence for changes in condition of alpine vegetation between historical and current. However, based on finer-scale information, changes in alpine soils and plants (for example, excessive erosion and removal of alpine vegetation) have been attributed to excessive grazing pressure by domestic sheep (Hann, Jones, Karl, et al. 1997).

Cold Forest Potential Vegetation Group

Cold Forest Potential Vegetation Types (PVTs):

Mountain hemlock-Inland
Spruce-fir, dry with aspen
Spruce-fir, dry without aspen
Spruce-fir, (whitebark pine greater than lodgepole pine)
Spruce-fir, (lodgepole pine greater than whitebark pine)
Whitebark pine/subalpine larch-North
Whitebark pine/subalpine larch-South
Mountain hemlock - East Cascades
Mountain hemlock/Shasta red fir
Alpine Shrub - Herbaceous

Background

The cold forest potential vegetation group is a major vegetation component at higher elevations, but it occurs on only about 10 percent of the ICBEMP project area. The Forest Service or BLM administers 87 percent of the cold forest PVG. The cold forest PVG is primarily distributed in the Upper Clark and Central Idaho Mountains ERUs in central Idaho and southwest Montana, and in the Northern Cascades in Washington.

Subalpine sites that support cold forests are more difficult for tree establishment and growth, and they define the upper limits of tree survival on mountains.

Table 2-7. Composition and Structure of Vegetation, with Associated Terrestrial Families, Alpine Potential Vegetation Group.

Terrestrial Community	Cover Type	Structural Stage	Terrestrial Families
Alpine	Alpine Tundra	Closed Low Shrub	3, 5
		Open Low Shrub	3, 5

Source: Appendices 3A, 3B, 3F; Hann, Jones, Karl, et al. 1997, Wisdom, et al. (in press).

Changes in cold forest vegetation composition and structure have resulted in a 95 percent loss of whitebark pine/alpine larch, and in changes in fire type and frequency.

Cold forests are generally limited by a short growing season and on some sites by low available moisture as well. Rates of tree growth are generally slow in comparison to moist forests. Nutrients are often limited, and loss of volcanic ash soil, litter, surface soil, or tree foliage from the site can greatly reduce productivity. Maintenance of dead and downed wood on these sites is important for nutrient cycling (Hann, Jones, Karl, et al. 1997).

Tree regeneration in the cold forest PVG is generally slow; mortality from stress, insects, and disease generally thins the stands and accelerates growth of the surviving trees. Whitebark pine may be codominant with subalpine fir in stands at the upper limits of tree growth. Whitebark pine forests exist in harsh areas with high winds; they can withstand severe ice and snow damage which create open or clumped stands (Johnson et al. 1994). Other vegetation of the cold forest PVG includes shrubs and grasses, many of which are perennial species that can survive years in which flowering and fruiting cycles are disrupted by the early arrival of killing frosts. Cold forests extend into moist forests along stream courses, cold air pockets, or other cold sites (Hann, Jones, Karl, et al. 1997). For a complete discussion on the composition, structure, and historical response of the cold forest PVG, please refer to Hann, Jones, Karl, et al. (1997).

Maps 2-5 and 2-6, earlier in this chapter, show the historical and current distributions of the cold forest potential vegetation group.

Current Conditions and Trends

Composition and Structure

Cold forests have longer fire intervals and fewer human-caused disturbances than dry or moist forests, so changes in forest structure and composition are not as noticeable in the cold forest as in the other forest PVGs. The cold climate and short growing season in cold forests also slow the natural rate of change in vegetation when compared to dry or moist forests. However, some changes from historical conditions have occurred. The cold forest PVG has generally shifted from a dominance by shade-intolerant species to a predominance of shade-tolerant species or a mixture of shade-tolerant and intolerant species. Changes in vegetation composition and structure have resulted in an approximately 95 percent loss of whitebark pine/alpine larch, and in changes in fire type and frequency (Table 2-8). Where whitebark pine and alpine larch have declined, they have been replaced by Engelmann spruce and subalpine fir. In particular, loss of whitebark pine and alpine larch and overstocking of forests have become forest health concerns in the past ten years. Future cold forests will not provide the diversity of habitats as they did in the past (Hann, Jones, Karl, et al. 1997).

The largest structural change in the cold forest PVG is the nearly 30 percent increase in the extent of early seral forests, most of which are now dominated by shade-tolerant species (Hann, Jones, Karl, et al. 1997). Some of this increase has come from a decline in the old forest multi-story structure and some has come from a decline in the extent of mid seral forests. Since the historical period, the amount of early seral shade-tolerant forests has nearly doubled.

Fire Regime

Cold forests have experienced higher amounts of lethal fires in the past ten years than they did under historical conditions, partly because of the spread of fires from other forest types during drought periods. Additionally, changes in landscape structure and composition have typically resulted in higher surface fuel loads and greater crowning potential over larger areas. The predominant fire regime is now lethal stand-replacing fires (about 59 percent in the Upper Basin portion of the project area and 44 percent in the Eastside portion), most of which burn at very infrequent intervals of 150 to 300 years. About 50 percent of fires are mixed severity, and nonlethal underburns have essentially been eliminated from the present fire regime. (See Maps 2-7 through 2-10 earlier in this chapter, and Table 2-8)

Insects and Disease

White pine blister rust is an introduced disease that has had a devastating impact on whitebark pine in the cold forest PVG, killing many trees and reducing the vigor in others. It has changed successional pathways, cover types, and/or structures of whitebark pine forests. This has seriously affected native successional potentials in at least 50 percent of the

Table 2-8. Changes in Fire Regimes, Cold Forest.

Fire Regime Class	Historical	Current
	Percent of Forest Service- and BLM-Administered Lands	
Nonlethal underburns, very frequent (<25 years)	0.0	0.0
Nonlethal underburns, frequent (26–75 years)	8.8	0.0
Nonlethal underburns, infrequent (76–150 years)	1.3	0.0
Total nonlethal underburns	**10.1**	**0.0**
Mixed severity, very frequent (<25 years)	0.0	0.0
Mixed severity, frequent (26–75 years)	3.9	0.0
Mixed severity, infrequent (76–150 years)	67.0	43.2
Mixed severity, very infrequent (151–300 years)	5.1	0.0
Total mixed severity	**76.0**	**43.2**
Lethal, stand-replacing, very frequent (<25 years)	0.0	0.0
Lethal, stand-replacing, frequent (26–75 years)	4.5	0.0
Lethal, stand-replacing, infrequent (76–150 years)	1.6	13.3
Lethal, stand-replacing, very infrequent (151-300 years)	7.9	43.6
Lethal, stand-replacing, extremely infrequent (>300 years)	0.0	0.0
Total lethal, stand-replacing	**14.0**	**56.9**

Source: ICBEMP GIS Data (1KM^2 raster data)

cold forest PVG, where whitebark pine was a dominant or common residual large tree structure (Hann, Jones, Karl, et al. 1997).

Mountain pine beetle is an important pest of lodgepole pine. Historically, when the density of lodgepole pine forests reached such a level that inner tree competition limited tree vigor, mountain pine beetles attacked and killed large numbers of trees which provided fuel for a stand-replacing fire. The fire prepared the mineral soil seedbed necessary for regeneration of the lodgepole pine forest and allowed the release of seed from serotinous cones stored on the tree. The cycle was repeated over and over.

Today outbreaks of mountain pine beetle infest larger areas, for longer periods, and often with greater intensity than occurred historically. Consequently, the patch sizes of the wildfires that sometimes follow are much larger than they typically were historically. Increasing size of susceptible stands of trees have also contributed to higher levels of other insects and diseases (Hann, Jones, Karl, et al. 1997).

Human Disturbance

Some of the old multi-story forest has been harvested in the cold forest potential vegetation group. Although the extent of old single story forest has not changed much, its composition has changed with the loss of whitebark pine due to blister rust. Young forests have increased, generally as a result of harvesting old multi-story forests. These harvested areas generally do not have the number of snags that occurred historically, which limits habitat for birds, mammals, and insects that need dead trees (Hann, Jones, Karl, et al. 1997).

Historically, shade-intolerant species dominated regeneration and young forest environments. This relationship has been altered, resulting in landscapes that now have mixed dominance or are dominated by shade-tolerant species, such as extensive areas where conifers have replaced or are replacing aspen. This is especially true where timber harvest and fire exclusion have favored the establishment of shade-tolerant species. As a result, much of the area where investments have been made (roads, harvest, planting, thinning, etc.) is highly susceptible to tree mortality from fire, insects, disease, and stress (Hann, Jones, Karl, et al. 1997).

Terrestrial Communities

Eight terrestrial communities can be found in the cold forest PVG. The communities and their status are shown in Table 2-9.

Table 2-9. Terrestrial Communities and Status, Cold Forest.

Terrestrial Community	Status (Geographic Extent)
Early seral montane forest	Stayed constant
Early seral subalpine forest	Increased substantially
Late seral montane single story forest	Declined substantially
Late seral montane multi-story forest	Stayed constant
Late seral subalpine multi-story forest	Declined substantially
Late seral subalpine single story forest	Increased substantially
Mid seral montane forest	Decreased somewhat
Mid seral subalpine forest	Stayed constant

Definition of status:
Declined substantially - current is less than 80% of historical extent.
Decreased somewhat - current is 80-95% of historical extent.
Increased substantially - current is more than 120% of historical extent.
Stayed constant - current is 95-105% of historical extent.

Source: Hemstrom, et al. 1999

Source Habitats: Cover Type-Structural Stages

Seven of the eight Terrestrial Families that use forest habitats (Families 2, 3, 4, 5, 6, 7, and 8), use cover type/ structural stage combinations that can be found in the cold forest PVG (Table 2-10). Most of the Families are generalists. They use a variety of habitats from early to late seral, and several different cover types.

The cold forest PVG contains 52 different cover type–structural stage combinations. The dominant species found in the cold forest PVG are: whitebark pine, Engelmann spruce/ subalpine fir, interior Douglas-fir, lodgepole pine, and the shrub/herb regeneration. These cover types can be matched with some or all of eight different structural stages: old forest single story, old forest multi-story, unmanaged young forest, managed young forest, understory reinitiation, stem exclusion open canopy, stem exclusion closed canopy, and stand initiation (Table 2-10).

Some of the cover type–structural stage combinations have expanded in extent since historical times and others have shown a reduction in area. In general, the vegetation is not as different from that historically in the cold forest PVG as in the other forest PVGs. Only three cover type–structural stage combinations from the cold forest have declined substantially in geographic extent from the historical to current period throughout their range: *lodgepole pine* unmanaged young multi-story structure (especially in ERUs 1, 2, 3, 7, 9, and 12) has declined a moderate amount; the *lodgepole pine* stem exclusion closed canopy (especially in ERUs 2, 3, 6, 7, 12, and 13) and the *whitebark pine* unmanaged young multi-story (especially in ERUs 1, 12, and 13) have declined to a lesser extent. The cover type/ structural stage combinations within the cold forest PVG that have *increased* the most are *interior Douglas-fir* managed young multi-story; *Engelmann spruce* stem exclusion closed canopy, and stand-initiation; *lodgepole pine* stand-initiation; and *shrub/herb regeneration* open low-medium shrub and closed low-medium shrub.

Since the two cover type–structural stage combinations used by Terrestrial Family 4 (early seral forest family) in the cold forest have increased substantially, it can be inferred that Terrestrial Family 4 should do very well in the cold forest. However, Family 4 uses more of the cover type–structural stage combinations in the dry and moist forest PVGs. For Terrestrial Family 8 (rangeland, early and late seral forest), since the only cover type–structural stage combination used by Family 8 in the cold forest PVG declined somewhat, it could be inferred that the species in Family 8 are not flourishing in the cold forest. For the other five Terrestrial Families that reside in the cold forest, it is more difficult to draw conclusions, because most of these families use many of the cold forest cover type–structural stage combinations, some of which have increased and some of which have decreased.

Table 2-10. Cover Type–Structural Stage Combinations, with Associated Terrestrial Families, Cold Forest Potential Vegetation Group.

Cover Type	Structural Stage	Terrestrial Community	Terrestrial Family
Aspen	Stem exclusion closed	Riparian woodland	3, 5, 7
	Stand initiation	Riparian woodland	2, 3, 4, 5, 6, 7, 8
	Understory reinitiation[1]	Riparian woodland	2, 3, 5, 6, 7
Engelmann spruce/ subalpine fir	Old forest multi-story[1]	Late seral subalpine multi	2, 3, 5, 6, 7
	Unmanaged young[1]	Mid seral subalpine	2, 3, 5, 7
	Managed young	Mid seral subalpine	3, 5, 7
	Understory reinitiation	Mid seral subalpine	2, 3, 5, 6, 7
	Stem exclusion closed	Mid seral subalpine	3, 5, 7
	Stand initiation	Early seral subalpine	2, 3, 4, 5, 6, 7
Grand fir/White fir	Old forest multi-story	Late seral montane multi	2,3,5,6,7
	Stem exclusion closed	Mid seral montane	3, 5, 7
	Stand initiation	Early seral montane	2, 3, 4, 5, 6, 7
	Understory reinitiation	Mid seral montane	2, 3, 5, 6, 7
	Unmanaged young	Mid seral montane	2, 3, 5, 6, 7
	Managed young	Mid seral montane	3, 5, 7
Interior Douglas-fir	Old forest single story	Late seral montane single	2, 3, 5, 6, 7
	Old forest multi-story	Late seral montane multi	1, 2, 3, 5, 6, 7
	Unmanaged young	Mid seral montane	2, 3, 5, 6, 7
	Managed young	Mid seral montane	3, 5, 6, 7
	Understory reinitiation	Mid seral montane	2, 3, 5, 6, 7
	Stem exclusion closed[1]	Mid seral montane	3, 5, 6, 7
	Stand initiation	Early seral montane	2, 3, 4, 5, 6, 7, 8
Lodgepole pine	Old forest single story[1]	Late seral montane single	2, 3, 5, 6, 7
	Old forest multi-story	Late seral montane multi	2, 3, 5, 6, 7
	Unmanaged young	Mid seral montane	2, 3, 5, 6, 7
	Managed young	Mid seral montane	2, 3, 5, 7
	Understory reinitiation	Mid seral montane	2, 3, 5, 7
	Stem exclusion closed	Mid seral montane	3, 7
	Stand initiation[1]	Early seral montane	2, 3, 4, 5, 7
Mountain Hemlock	Old forest multi-story[1]	Late seral subalpine multi	2, 3, 5, 6, 7
	Unmanaged young	Mid seral subalpine	2, 3, 5, 7
	Managed young	Mid seral subalpine	3, 5, 7
	Understory reinitiation	Mid seral subalpine	2, 3, 5, 6, 7
	Stem exclusion closed	Mid seral subalpine	3, 5, 7
	Stand initiation	Early seral subalpine	2, 3, 5, 6, 7
Red fir	Old forest multi-story	Late seral montane multi	2, 3, 5, 6, 7
	Stem exclusion closed	Mid seral montane	3, 7
	Stand initiation	Early seral montane	2, 3, 5, 7
	Understory reinitiation	Mid seral montane	2, 3, 5, 7
	Unmanaged young	Mid seral montane	2, 3, 5, 6, 7
	Managed young	Mid seral montane	3, 5, 7
Shrub/herb/tree regeneration	Open tall shrub	Early seral montane	3, 5
	Closed low-med shrub	Early seral montane	2, 3, 5
Western larch	Old forest multi-story[1]	Late seral montane multi	1, 2, 3, 5, 6, 7
	Stem exclusion closed	Mid seral montane	3, 6, 7
	Stand initiation[1]	Early seral montane	2, 3, 4, 5, 6, 7, 8
	Understory reinitiation	Mid seral montane	2, 3, 5, 6, 7
	Unmanaged young[1]	Mid seral montane	2, 3, 5, 6, 7
	Managed young	Mid seral montane	3, 5, 7

Table 2-10. Cover Type–Structural Stage Combinations, with Associated Terrestrial Families, Cold Forest Potential Vegetation Group. (continued)

Cover Type	Structural Stage	Terrestrial Community	Terrestrial Family
Whitebark pine	Old forest single story	Late seral subalpine single	2, 3, 5, 7
	Old forest multi-story[1]	Late seral subalpine multi	2, 3, 5, 7
	Unmanaged young[1]	Mid seral subalpine	2, 3, 5, 7
	Managed young	Mid seral subalpine	3, 5, 7
	Understory reinitiation[1]	Mid seral subalpine	2, 3, 5, 7
	Stem exclusion closed[1]	Mid seral subalpine	3, 5, 7
	Stand initiation[1]	Early seral subalpine	3, 5, 7
Whitebark pine/alpine larch	Old forest multi-story[1]	Late seral subalpine multi	2, 3, 5, 7
	Unmanaged young[1]	Mid seral subalpine	2, 3, 5, 7
	Managed young	Mid seral subalpine	3, 5, 7
	Understory reinitiation[1]	Mid seral subalpine	2, 3, 5, 7
	Stem exclusion open[1]	Mid seral subalpine	5, 7
	Stand initiation[1]	Early seral subalpine	3, 5, 7
Western white pine	Old forest multi-story[1]	Late seral montane multi	2,3,5,6,7
	Stem exclusion closed[1]	Mid seral montane	3,5,7
	Stand initiation[1]	Early seral montane	2,3,5,6,7,8
	Understory reinitiation[1]	Mid seral montane	2,3,5,6,7
	Unmanaged young	Mid seral montane	2,3,5,6,7
	Managed young	Mid seral montane	3,5,7

[1] These cover type/structural stages have declined substantially from the historical to current period.

Source: Wisdom et al. (in press); Appendices 3A, 3B, 3F in Hann, Jones, Karl, et al. (1997).

Moist Forest PVG

Moist Forest Potential Vegetation Types (PVTs):

- Cedar/hemlock-Inland
- Moist Douglas-fir
- Grand fir/white fir-Inland
- Spruce-fir, wet
- Cedar/hemlock- East Cascades
- Grand fir/white fir - East Cascades
- Pacific silver fir

Background

The moist forest potential vegetation group includes transitional areas between drier, lower elevation forest or woodland types in dry forests, and higher elevation subalpine forest types in cold forests (Agee 1993). Approximately 40 percent of the moist forest potential vegetation group in the project area occurs at elevations less than 4,000 feet (1,220 meters) the other 60 percent occurs above 4,000 feet. Moist forests cover approximately 18 percent of the project area; 64 percent of that is administered by either the Forest Service or BLM (Hann, Jones, Karl, et al. 1997). The moist forest PVG is primarily distributed in the Northern Cascades, Southern Cascades, Northern Glaciated Mountains, Lower Clark Fork, and the northern part of the Central Idaho Mountains ERUs.

Moist forests typically have relatively high soil moisture in the spring and early summer, followed by drought stress in the late summer and early fall. Available nutrients in the soil can limit productivity, particularly on sites where decomposition of dead wood and litter is slow and where harvest practices have caused soil loss or have removed a large proportion of wood, litter, duff, and small branches that contain the bulk of site nutrients. However, tree growth rates are generally rapid and these sites tend to be the most productive in the project area. Young forests develop relatively quickly into mid seral structures. The moist forest PVG has a productive environment which rapidly produces biomass and accumulates fuels. Insects and pathogens that attack trees are potentially very active in the moist forest environment.

As in the cold forest and dry forest PVGs, quaking aspen can be found in the moist forest PVG. Other vegetation in moist forest is highly diverse. Many of the shrub and herbaceous understories have evolved under more limited light and longer fire frequencies than in dry forest. Shrub species include: Oregon boxwood, big huckleberry, oceanspray, baldhip rose, streambank gooseberry, prince's pine, and American twinflower. Herbaceous plants are characterized by shade-tolerant species including: queencup beadlily, mountain lady's slipper orchid, heart-leaved arnica, wild ginger, sword fern, white trillium, and pioneer violet. Grasses include: pinegrass, Columbia brome, and tufted hairgrass. One sedge species, Ross' sedge, appears to be widely distributed across the project area in the moist forest PVG. For a complete discussion on the composition, structure, and historical response of the moist forest PVG, refer to Hann, Jones, Karl, et al. (1997) and Everett et al. (1994).

Maps 2-5 and 2-6, earlier in this chapter, show the historical and current distributions of the moist forest potential vegetation group.

Current Conditions and Trends

Composition and Structure

Changes to the structure and composition of vegetation since historical times is prevalent within moist forests. In general, these forest structure and composition changes are not as obvious in moist forests as the dry forest but more substantial than in the cold forest. Major changes to the moist forest potential vegetation group include: the network of roads and timber harvest units across the landscape; increased stand density in forests; increased dominance of young stands of even-aged shade-tolerant species such as grand fir, Douglas-fir, or white fir species; rapid decline in western white pine; reductions in early seral and old stands; and increases in young mid seral stands. These changes have decreased productivity and landscape diversity, increased the probability of severe or uncharacteristic disturbance events such as flood or fire, decreased habitat diversity, and unbalanced many of the natural processes and cycles.

Mid seral shade-tolerant forest has almost tripled in extent in the moist forest potential vegetation group since the historical period.

The late seral single story stage of these shade-intolerant species has decreased 90 percent from historical amounts, while the shade-tolerant species in the late seral single story stage have doubled from historical amounts. The late seral multi-story stage of these shade-intolerant species has decreased 78 percent from historical amounts, while the shade-tolerant species in the late seral multi-story stage have not changed from historical amounts. The early seral forest stage of shade-intolerant species is about half as extensive as it once was, while the early seral forest stage of shade-tolerant species has increased slightly. The highest increase was in the mid seral shade-tolerant forest, which almost tripled in extent since the historical period.

Moist forest landscapes are now dominated by shade-tolerant species or a mixture of shade-tolerant and intolerant species, particularly in areas that have been harvested and where fire suppression has been successful. These harvests have not generally left the snag structure that existed historically. Fire suppression has been most successful in roaded areas, which has substantially changed seral stage composition and community composition and structure.

Fire Regime

The most important change in the fire regime in moist forest has been the shift to 74 percent lethal stand-replacing fires in the Upper Basin portion of the project area (Idaho and western Montana) and 55 percent in the Eastside portion (eastern Oregon and eastern Washington; see Maps 2-7 through 2-10, earlier in this chapter, and Table 2-11). The effective exclusion of almost all nonlethal underburns (currently 3 and 17 percent respectively) and a reduction of mixed severity fires (currently 23 and 26 percent, respectively) has resulted in the development of dense multi-storied stands with high potential for stand-replacing fires. These highly productive forests have increased amounts of carbon and nutrients stored in woody material, resulting in fires that are of higher intensity and severity. Even where fires do not crown, dominant trees can be killed by consumption of large diameter surface fuels and duff layers. Potential for high amounts of soil heating and death of tree roots and other understory plants is much higher than it was historically.

Insects and Disease

Susceptibility to large-scale damage by insect infestations and diseases has increased in many moist forests, contributing to forest health problems. Tree

Table 2-11. Changes in Fire Regimes, Moist Forest.

Fire Regime Class	Historical	Current
	Percent of Forest Service- and BLM-Administered Lands	
Nonlethal underburns, very frequent (<25 years)	0.0	0.0
Nonlethal underburns, very frequent (<25 years)	10.9	0.0
Nonlethal underburns, frequent (26–75 years)	3.7	0.0
Nonlethal underburns, infrequent (76–150 years)	4.0	5.0
Total nonlethal underburns	**18.6**	**5.0**
Mixed severity, very frequent (<25 years)	3.5	0.0
Mixed severity, frequent (26–75 years)	24.0	1.9
Mixed severity, infrequent (76–150 years)	20.3	21.7
Mixed severity, very infrequent (151–300 years)	7.3	0.0
Total mixed severity	**55.1**	**23.6**
Lethal, stand-replacing, very frequent (<25 years)	0.0	0.0
Lethal, stand-replacing, frequent (26–75 years)	2.3	5.4
Lethal, stand-replacing, infrequent (76–150 years)	10.1	37.3
Lethal, stand-replacing, very infrequent (151–300 years)	13.8	28.6
Lethal, stand-replacing, extremely infrequent (>300 years)	0.0	0.0
Total lethal, stand-replacing	**26.2**	**71.3**

Source: ICBEMP GIS Data (1KM^2 raster data)

density has increased and vigor has decreased in moist Douglas-fir and grand fir forests, making them more susceptible to insect and disease damage. Timber harvest and mortality from fir engraver beetles in productive grand and white fir patches, has contributed to the sharp decline of this type in the Blue Mountains. Areas susceptible to western larch dwarf mistletoe decreased because the western larch cover type in the Northern Glaciated Mountains also decreased (Hann, Jones, Karl, et al. 1997).

An additional forest health concern is that, with few exceptions, areas susceptible to Armillaria root disease, laminated root rot, and S-group annosum root disease increased across the project area. Areas susceptible to Armillaria root disease increased in the Central Idaho Mountains, Lower Clark Fork, Northern Glaciated Mountains, Columbia Plateau, and Southern Cascades ERUs. Areas susceptible to S-group annosum root disease increased in the Central Idaho Mountains, Northern Glaciated Mountains, Columbia Plateau, and Northern Cascades ERUs.

White pine blister rust is the primary introduced disease that has changed successional pathways, cover types, and/or structures of western white pine in the moist forest. This has seriously affected native successional potentials in at least 50 percent of the moist forest PVG where western white pine was a dominant or common residual large tree structure.

Human Disturbance

Clearcuts or partial cuts where western larch, western white pine, and ponderosa pine were harvested have changed stand structure and composition. The resulting stands have few of the large dead or live trees that historically could have remained on most sites, even after intense fire events. With the selective removal of shade-intolerant species, seeds to grow new trees mainly came from shade-tolerant trees, trees with poor form/ growth, or off-site sources. Seed from poorly formed or undesired trees may pass on characteristics that will not provide the wood quality or other tree values desired in the future.

Tree harvest and fire exclusion have compounded forest health concerns through their roles in the extensive loss of western white pine to blister rust, and unsuccessful regeneration (Hann, Jones, Karl, et al. 1997). Western white pine has been replaced by grand fir and white fir (now representing 28 percent of the area in moist forest), western larch (24 percent), and shrub/herb/tree regeneration (17 percent). Aspen and Sierra mixed conifer forest types have also declined. Habitat diversity for wildlife provided by these forest types has also decreased, as have scenic qualities, recreation values, and wood products provided by species in decline.

Moist Forest, Aerial View: Loss of old forest structures in the moist forest is evident in the fairly uniform size class of the crown as seen from the air.

Photo by USFS.

Photo by USFS.

Moist Forest, Surface View: Predominantly young forest structures characterize the current condition of the moist forest in the project area.

Large trees, early seral stands, and old single storied stands have decreased because of the practice of harvesting and planting. Mid seral and multi-storied forests have increased.

Terrestrial Communities

Eight terrestrial communities can be found in the moist forest PVG. The communities and their status are shown in Table 2-12.

Source Habitats: Cover Type–Structural Stages

The moist forest PVG can include any of 64 different cover type–structural stage combinations in the project area. The dominant species that are found in the moist forest include: Pacific silver fir/mountain hemlock, western redcedar/mountain hemlock, interior Douglas-fir, western larch, grand fir/white fir, Sierra Nevada mixed conifer, western white pine, shrub or herb/tree regeneration, Pacific ponderosa pine, and interior ponderosa pine. The cover types can be matched with eight different structural stages: old forest single story, old forest multi-story, unmanaged young forest, managed young forest, understory reinitiation, stem exclusion open canopy, stem exclusion closed canopy, and stand initiation (Table 2-13).

All eight Terrestrial Families that use forested cover type–structural stage combinations (Families 1 through 8) can be found in moist forest habitats. Although Terrestrial Family 1 (low elevation old forest family) uses cover type–structural stage combinations that are found in both dry forest and moist forest PVGs (such as ponderosa pine old forest single story), most of them are predominantly in the dry forest PVG. Therefore any ties between trends in Family 1 source habitats and trends in the moist forest PVG are weak at best.

The trends in old forest of the moist forest PVG should be a good reflection of the trends for Terrestrial Family 2 (all elevation old forest family) source habitat; 46 of the 86 cover type–structural stage combinations that make up the source habitat for Terrestrial Family 2 can be found in the moist forest. Only 16 of these cover type–structural stage combinations are found exclusively in the moist forest PVG, but the moist forest PVG spans the middle of forest ecological conditions in the project area and includes most of the Terrestrial Family 2 source habitats that have declined substantially in geographic extent from the historical to current period: *interior ponderosa pine* old forest single story (in all ERUs except 10, 11, and 12), old forest multi-story structure (especially in ERUs 1, 2, 3, 7, 8, 9, and 13), and stand-initiation (in all ERUs except 10, 11, and 12); *western larch* old forest multi-story structure (especially in ERUs 7 and 8), young multi-story structure (especially in ERUs 1 and 2), and stand-initiation (especially in ERUs 7 and 8); *western white pine* multi-story structure (especially in ERUs 7 and 8), understory reinitiation (especially in ERUs 7 and 8), and stand-initiation (especially in ERUs 7 and 8); and *interior Douglas-fir* stand initiation (especially in ERUs 2, 3, 8, 9, and 13).

Terrestrial Family 4 source habitat contains 11 cover type–structural stage combinations. Seven of those occur in the moist forest. The two cover type–

Table 2-12. Terrestrial Communities and Status, Moist Forest.

Terrestrial Community	Status (Geographic Extent)
Early seral lower montane forest	Declined substantially
Early seral montane forest	Declined substantially
Late seral lower montane multi-story forest	Declined substantially
Late seral lower montane single story forest	Declined substantially
Late seral montane multi-story forest	Declined substantially
Late seral montane single story forest	Increased substantially
Mid seral lower montane forest	Increased somewhat
Mid seral montane forest	Increased substantially

Definition of status:
Declined substantially - Current is less than 80% of historical extent
Increased somewhat - Current is 105-120% of historical extent
Increased substantially - Current is more than 120% of historical extent

Source: Hemstrom, et al. 1999

Table 2-13. Cover Type–Structural Stage Combinations, with Associated Terrestrial Families, Moist Forest Potential Vegetation Group.

Cover Type	Structural Stage	Terrestrial Community	Terrestrial Family
Engelmann spruce/Subalpine fir	Old forest multi[1]	Late seral subalpine multi	2, 3, 5, 6, 7
	Unmanaged young[1]	Mid seral subalpine	2, 3, 5, 7
	Managed young	Mid seral subalpine	3, 5, 7
	Understory reinitiation	Mid seral subalpine	2, 3, 5, 6, 7
	Stem exclusion closed	Mid seral subalpine	3, 5, 7
	Stand initiation	Early seral subalpine	2, 3, 4, 5, 6, 7
Grand fir/ white fir	Old forest single story	Late seral montane single	2, 3, 5, 6, 7
	Old forest multi	Late seral montane multi	2, 3, 5, 6, 7
	Unmanaged young	Mid seral montane	2, 3, 5, 6, 7
	Managed young	Mid seral montane	3, 5, 7
	Understory reinitiation	Mid seral montane	2, 3, 5, 6, 7
	Stem exclusion closed	Mid seral montane	3, 5, 7
	Stand initiation	Early seral montane	2, 3, 4, 5, 6, 7
Interior Douglas-fir	Old forest single story	Late seral montane single	2, 3, 5, 6, 7
	Old forest multi	Late seral montane multi	1, 2, 3, 5, 6, 7
	Unmanaged young	Mid seral montane	2, 3, 5, 6, 7
	Managed young	Mid seral montane	3, 5, 6, 7
	Understory reinitiation	Mid seral montane	2, 3, 5, 6, 7
	Stem exclusion closed[1]	Mid seral montane	3, 5, 6, 7
	Stand initiation	Early seral montane	2, 3, 4, 5, 6, 7, 8
Interior ponderosa pine	Old forest single story[1]	Late seral lower montane single	1, 2, 3, 5, 6, 7, 8
	Old forest multi[1]	Late seral lower montane multi	1, 2, 3, 5, 6, 7
	Unmanaged young	Mid seral lower montane	1, 2, 3, 5, 6, 7
	Managed young	Mid seral lower montane	1, 3, 5, 6, 7
	Understory reinitiation	Mid seral lower montane	2, 3, 5, 6, 7
	Stem exclusion closed[1]	Mid seral lower montane	6, 7
	Stand initiation[1]	Early seral lower montane	2, 3, 4, 5, 6, 7, 8, 10
Lodgepole pine	Old forest multi	late seral montane multi	2, 3, 5, 6, 7
	Understory reinitiation	Mid seral montane	2, 3, 5, 7
	Stem exclusion closed	Mid seral montane	3, 7
	Stand initiation[1]	early seral montane	2, 3, 4, 5, 7
	Unmanaged young	Mid seral montane	2, 3, 5, 6, 7
	Managed young	Mid seral montane	2, 3, 5, 7
Mountain hemlock	Old forest single story	late seral subalpine single	2, 3, 5, 6, 7
	Old forest multi[1]	late seral subalpine multi	2, 3, 5, 6, 7
	Understory reinitiation	Mid seral subalpine	2, 3, 5, 6, 7
	Stem exclusion closed	Mid seral subalpine	3, 5, 7
	Stand initiation	early seral subalpine	2, 3, 5, 6, 7
Pacific silver fir/mountain hemlock	Old forest multi	Late seral montane multi	2, 3, 5, 6, 7
	Unmanaged young	Mid seral montane	2, 3, 5, 6, 7
	Managed young	Mid seral montane	3, 5, 7
	Understory reinitiation	Mid seral montane	2, 3, 5, 6, 7
	Stem exclusion closed	Mid seral montane	3, 7
	Stand initiation	Early seral montane	2, 3, 5, 6, 7
Shrub/ herb/ tree regeneration	Closed low-med shrub	Early seral montane	2, 3, 5
	Open low-med shrub	early seral montane	2, 3, 5

Table 2-13. Cover Type–Structural Stage Combinations, with Associated Terrestrial Families, Moist Forest Potential Vegetation Group. (continued)

Cover Type	Structural Stage	Terrestrial Community	Terrestrial Family
Western red cedar/Western hemlock	Unmanaged young[1]	Mid seral montane	2, 3, 5, 6, 7
	Managed young	Mid seral montane	3, 5, 6, 7
	Understory reinitiation	Mid seral montane	2, 3, 5, 6, 7
	Stem exclusion closed	Mid seral montane	3, 5, 6, 7
	Stand initiation	Early seral montane	2, 3, 5, 6, 7
	Old forest single story	late seral montane single	2, 3, 5, 6, 7
	Old forest multi	late seral montane multi	2, 3, 5, 6, 7
Western larch	Old forest single story[1]	Late seral montane single	2, 3, 5, 6, 7
	Old forest multi[1]	Late seral montane multi	1, 2, 3, 5, 6, 7
	Unmanaged young[1]	Mid seral montane	2, 3, 5, 6, 7
	Managed young	Mid seral montane	3, 5, 7
	Understory reinitiation	Mid seral montane	2, 3, 5, 6, 7
	Stem exclusion closed	Mid seral montane	3, 6, 7
	Stand initiation[1]	Early seral montane	2, 3, 4, 5, 6, 7, 8
Western white pine	Old forest single story	Late seral montane single	2, 3, 5, 6, 7, 8
	Old forest multi[1]	Late seral montane multi	2, 3, 5, 6, 7
	Managed young	Mid seral montane	3, 5, 7
	Understory reinitiation[1]	Mid seral montane	2, 3, 5, 6, 7
	Stem exclusion closed[1]	Mid seral montane	3, 5, 7
	Stand initiation[1]	Early seral montane	2, 3, 5, 6, 7, 8
	Unmanaged young	Mid seral montane	2, 3, 5, 6, 7

[1] These cover type-structural stages have declined substantially from the historical to current period.

Source: Wisdom et al. (in press); Appendices 3A, 3B, 3F in Hann, Jones, Karl, et al. (1997).

structural stage combinations from the Terrestrial Family 4 source habitat that have declined the most in geographic extent from the historical to current periodare the *interior ponderosa pine* (in all ERUs except 10, 11, and 12) and *western larch* (especially in ERUs 7 and 8) stand-initiation stages. The *interior Douglas-fir* stand-initiation stage has also declined substantially in geographic extent from the historical to current period.

Conclusions about source habitats for the forest generalists and the forest/rangeland generalists families (Terrestrial Families 3, 5, 6, 7, and 8) are more favorable than for Terrestrial Families 1, 2, and 4. Other cover type–structural stage combinations that have declined substantially in geographic extent from the historical to current period which are not included in the source habitats for Terrestrial Families 1, 2, and 4 are few: *interior ponderosa pine* (in all ERUs except 10, 11, and 12) and *western white pine* (especially in ERUs 7 and 8), in the stem exclusion closed canopy stage. In total, 14 of the 66 cover type–structural stage combinations found in the moist forest have declined substantially in geographic extent from the historical to current period.

In order for some of the cover type–structural stage combinations to have declined in extent in the moist forest, some of the cover type–structural stage combinations must have increased. The cover type/structural stage combinations that have expanded the most are: *interior Douglas-fir* managed young multi-story (all ERUs), old forest multi-story (especially in ERUs 1, 2, 3, and 6), old forest single story structure (especially in ERUs 2 and 3), and understory reinitiation (especially in ERUs 1, 7, 8, and 9); *grand fir/white fir* stem exclusion closed canopy (especially in ERUs 7 and 8), old forest multi-story structure (especially in ERUs 1, 2, 3, 4, 6, and 13), managed young multi-story (especially in ERUs 2, 5, 6, 7, 8, and 13), and understory reinitiation (especially in ERUs 7, 8, and 13); *western larch* understory reinitiation (especially in ERUs 7 and 8); *interior ponderosa pine* managed young multi-story (especially in all ERUs except 10, 11, and 12), and unmanaged young multi-story (in ERU 6); *Pacific ponderosa pine* managed young multi-story (in ERUs 1, 2, and 3); and *shrub/herb-regeneration* open low-medium shrub (in ERUs 7 and 8), and closed low-medium shrub (especially in ERUs 2, 3, 9, and 13).

Dry Forest PVG

Dry Forest Potential Vegetation Types (PVTs):

Dry Douglas-fir without ponderosa pine
Dry Douglas-fir with ponderosa pine
Dry grand fir/white fir
Interior ponderosa pine
Lodgepole pine - Oregon
Lodgepole pine -Yellowstone
Pacific ponderosa pine/Sierra mixed conifer

Background

The dry forest potential vegetation group (PVG) currently makes up 18 percent of the ICBEMP project area, with 69 percent of the PVG occurring above 4,000 feet (1,220 meters) in elevation. The Forest Service or BLM administer 56 percent of dry forests in the project area (Hann, Jones, Karl, et al. 1997). The dry forest PVG is primarily distributed in ERUs 2, 3, 6, 7, 9, and 13 in northeast Washington, northeast Oregon, south central Oregon, central Idaho and western Montana.

Shade-tolerant and Shade-intolerant Trees

Shade-intolerant trees—those that need full sunlight to regenerate, survive and grow— may dominate newly opened forested areas. They may continue to dominate if disturbance events remove enough of the existing trees to allow a new generation to reproduce and grow in the sunny, open areas. If such a disturbance does not open up the forest to sunlight, shade-intolerant trees mature, grow more dense, and create shade on the forest floor; the shade does not allow their own seedlings to become established but does allow other trees that don't need as much sunlight (shade-tolerant species), to germinate and grow. These new trees will continue to grow in the shade of the overstory. They will eventually dominate the forest unless they are removed by fire, wind, harvest, or another disturbance that maintains the shade-intolerant overstory or returns sunlight to the forest floor and allows shade-intolerant species to once again become established in open areas. In the project area, mid seral shade-tolerant forests have increased in area and become significantly more continuous in extent. This has affected disturbance processes such as fire, insects, and disease, and severely changed the availability of other habitats.

Common shade-tolerant trees include, but are not limited to:
- Douglas-fir (sometimes)
- Engelmann spruce
- Grand fir
- Subalpine fir
- Western hemlock
- Western redcedar
- White fir

Common shade intolerant species include, but are not limited to:
- Aspen
- Douglas-fir (sometimes)
- Interior ponderosa pine
- Lodgepole pine
- Pacific ponderosa pine (Eastside only)
- Western larch (sometimes on the Eastside)
- Western white pine
- Whitebark pine

Forest vegetation in dry forest PVGs generally is limited by low water availability and often is subject to drought. Dry forest areas can also be stressed by limited nutrients if surface soils are eroded or displaced, or if tree density is high. Quaking aspen is one of few non-coniferous trees associated with the dry forest PVG. Non-tree vegetation is diverse. On dry sites, shrubs are generally widely spaced in the understory beneath tree cover and are fire-adapted and medium to very shade-intolerant. Spaces between shrubs are generally occupied by fire-tolerant and shade-intolerant grasses and forbs. The dry forest PVG frequently borders on grasslands, which form alternating vegetative patterns interspersed with tree-dominated stands. Between grassland and tree-dominated patches, shrubs may be dense. For a complete discussion on the composition, structure, and historical response of the dry forest PVG, see Hann, Jones, Karl, et al. (1997).

The historical and current distributions of the dry forest potential vegetation group are shown on Maps 2-5 and 2-6, earlier in this chapter.

Current Conditions and Trends

Composition and Structure

Although the actual loss in extent of the dry forest potential vegetation group from historical amounts has been slight, the composition, structure, and disturbance patterns in dry forests have changed significantly. Human-caused disturbances have been more pronounced in the dry forest potential vegetation group than in the moist or cold forest groups.

In the Upper Basin portion of the project area there are currently 25 percent more young tree stands than there were historically. In the Eastside area, there are close to historical levels of young stands. Historically, these types of stands were created by wildfire and other kinds of disturbance. Often the forests were slow to regenerate (Wisdom et al. in press). Today these types of stands are most often created by harvesting and are missing the scattered large live and dead trees that would have been present if a fire had initiated the stand (Hann, Jones, Karl, et al. 1997). Averaged across the project area, ponderosa pine has been replaced by grand fir and white fir on 19 percent of its range, and by interior Douglas-fir on another 20 percent of its range. The old single story stage of ponderosa pine is at 25 percent or less than its historical amount. On the other hand, the old multi-story stage of Douglas-fir, grand fir, and white fir is approximately three times its historical amount, while the young forest structural stages of Douglas-fir, grand fir, and white fir are nearly double their historical amounts. Western larch stands have been replaced by Douglas-fir (16 percent), lodgepole pine (12 percent), and grand fir or white fir (10 percent).

Currently, 30 percent of stands within dry forests are dominated by shade-tolerant species, more than twice the amount that existed in the early 1800s (Hann, Jones, Karl, et al. 1997).

In some cases, dry forest conifers have encroached into rangeland types. For instance, there have been shifts of upland herbland to mid seral interior ponderosa pine and interior Douglas-fir, especially in the Upper Clark Fork and Upper Klamath ERUs. In other places in the dry forest PVG, upland shrubland has converted to mid seral forest—such as in the Snake Headwaters where the interior Douglas-fir type has increased at the expense of the mountain big sagebrush type.

The clumpy character of historical stands that was created by fire has changed. We now see larger stands with more uniformity within stands and more contrast between stands. Overall, stand structures have changed from open park-like stands of large trees with clumps of small trees, to dense overstocked young stands with several canopy layers (Caraher et al. 1992, Gast et al. 1991 in Lehmkuhl et al. 1994). Landscapes once dominated by shade-intolerant species are less than half their historical level.

Fire Regime

About 39 percent of acres in the Upper Basin portion of the project area and 45 percent of the Eastside portion currently have the potential to sustain nonlethal underburns, but they occur at frequencies greater than 76 years. Currently about 36 and 35 percent of the areas have a mixed severity regime, most ranging in occurrence between 76 to 150 years. Lethal stand-replacing fires in the dry forest occur on 25 and 17 percent of the areas, at rates three times greater than historical in the Upper Basin and 50 percent greater in the Eastside area. About 54 and 46 percent of the area that used to burn with nonlethal fires now has a mixed severity or lethal stand-replacing fire regime. (See Maps 2-7 through 2-10, earlier in this chapter, and Table 2-14.) The dense mid seral structures of the dry forest have high risks for crown fire and intense fire events. The current period fire interval doubled or tripled to approximately 40 to 80 years.

Table 2-14. Changes in Fire Regimes, Dry Forest.

Fire Regime Class	Historical	Current
	Percent of Forest Service-and BLM-administered Lands	
Nonlethal underburns, very frequent (<25 years)	0.0	0.0
Nonlethal underburns, very frequent (<25 years)	60.1	0.1
Nonlethal underburns, frequent (26–75 years)	14.4	0.1
Nonlethal underburns, infrequent (76–150 years)	11.4	41.6
Total nonlethal underburns	**85.9**	**41.8**
Mixed severity, very frequent (<25 years)	0.0	0.0
Mixed severity, frequent (26–75 years)	1.0	5.5
Mixed severity, infrequent (76–150 years)	3.3	31.2
Mixed severity, very infrequent (151–300 years)	0.0	0.0
Total mixed severity	**4.3**	**36.7**
Lethal, stand-replacing, very frequent (<25 years)	0.0	0.0
Lethal, stand-replacing, frequent (26–75 years)	7.8	0.1
Lethal, stand-replacing, infrequent (76–150 years)	2.0	21.3
Lethal, stand-replacing, very infrequent (151–300 years)	0.0	0.1
Lethal, stand-replacing, extremely infrequent (>300 years)	0.0	0.0
Total lethal, stand-replacing	**9.8**	**21.5**

Source: ICBEMP GIS Data (1 km^2 raster data)

Fuel moisture is greater in dense stands, particularly in small diameter fuels, because increased shading and reduced wind speed decrease the drying rate of forest fuels. Total available fuel has generally increased everywhere in dry forests. However, within dense stands, the rate of fuel increase is even greater because more dead woody material is available.

Fire exclusion effects have been highest in the most heavily roaded areas. Development of residential areas and other cultural facilities in project area forests has been most common in the dry forest PVG, which, coupled with the changed fire regime, has caused a greatly increased risk to life and property.

Insects and Disease

The insect and disease relationship as it relates to forest health in dry forests has changed as forest structure has changed. Insects and diseases always existed in forests, but the size and intensity of their attacks have increased in recent years (Caraher et al. 1992, Gast et al. 1991 in Lehmkuhl et al. 1994). With the exclusion of fire, stand densities are often much greater, and species composition has changed to dominance by trees such as Douglas-fir, grand fir, and white fir. Bark beetles currently often replace fire in eliminating trees growing in excess of site potential.

Susceptibility to the Douglas-fir beetle has increased in the Blue Mountains, Lower Clark Fork, and Snake Headwaters ERUs, and declined in the Southern Cascades compared to historical conditions. This was attributed to increased contagious spread of shade-tolerant Douglas-fir, increased abundance of host trees of adequate size for successful bark beetle breeding, increased patch densities and layering of canopies, and increased landscape contiguity of susceptible areas.

Susceptibility to fir engraver beetle increased in the Central Idaho Mountains and Upper Clark Fork ERUs and declined in the Blue Mountains. While grand fir and white fir have increased in area in the Blue Mountains, that increase is occurring in the understories of multi-storied patches. Timber harvest and fir engraver mortality of productive grand fir and white fir patches have contributed to the precipitous decline in that cover type in the Blue Mountains ERU.

Susceptibility to defoliators (needle-eating insects) such as western spruce budworm and Douglas-fir tussock moth has increased in several ERUs and declined in none. The increased susceptibility was attributed to increases in shade-tolerant Douglas-fir, grand fir, and white fir and the increased density and layering of canopies. These insects have been active in all ERUs in the project area, especially in the Southern Cascades and the Columbia Plateau ERUs.

In the Southern Cascades and the Snake Headwaters ERUs, lodgepole pine forests recently were hosts to mountain pine beetle attacks. Areas susceptible to spruce beetle declined significantly in the Blue Mountains. This is especially noteworthy because beetle outbreaks during the last decade reduced spruce stands in valley bottoms and on benches that were once common in the Blue Mountains.

The extent of forests infected with Douglas-fir dwarf mistletoe increased in the Blue Mountains and Snake Headwaters ERUs and declined in the Upper Clark Fork and Southern Cascades ERUs. Areas susceptible to ponderosa pine dwarf mistletoe decreased with the declining area in the ponderosa pine cover type in the Northern Cascades, Blue Mountains, and Northern Glaciated Mountains ERUs.

An additional forest health concern is that, with few exceptions, areas susceptible to Armillaria root disease, laminated root rot, and S-group annosum root disease increased across the project area. Areas susceptible to Armillaria root disease increased in the Central Idaho Mountains, Lower Clark Fork, Northern Glaciated Mountains, Columbia Plateau, and Southern Cascades ERUs. Areas susceptible to S-group annosum root disease increased in the Central Idaho Mountains, Northern Glaciated Mountains, Columbia Plateau, and Northern Cascades ERUs.

The increasing number of small dead trees in stands attacked by insects and diseases makes forests even more susceptible to large high-intensity fires.

The increasing number of small dead trees in stands attacked by insects and diseases makes forests even more susceptible to large high-intensity fires. The stands that are most susceptible to moisture stress, insects, and disease tend to be those at the lowest elevations, which typically border private, state, tribal, or other land ownerships. Homes, private, tribal, and state forest resources, wildlife winter ranges, and other important resources are increasingly at risk from fire and insect and disease attack from lands administered by the BLM and Forest Service (Everett et al. 1994).

Human Disturbance

In general, forests showing the most change are those that have been roaded and harvested. Large trees of high-value species, such as ponderosa pine, were selectively logged. True firs, Douglas-fir, and lodgepole pine were left in stands either because these species were not desirable on the timber market or because they were smaller trees and could not be processed efficiently. The remaining trees, which were not always the best genetic stock, provided seeds for the next generation of forest. These stands now exhibit changes in forest health including a loss of growth potential due to overstocking, greater risk of severe insect and disease problems, greater risk of high severity fires, and a loss of habitat diversity in the forested site when compared to historical conditions.

The dry forest PVG is particularly vulnerable to the introduction of exotic species (noxious weeds). Noxious weeds such as knapweed are rapidly displacing native species in some places. The results include changes in fire regimes, changes in succession pathways, loss of biodiversity, more exposed mineral soil and erosion potential, loss of habitat suitability for some terrestrial species, and lost productivity.

Terrestrial Communities

Eight terrestrial communities exist in the dry forest potential vegetation group. The terrestrial community groups and their status are shown in Table 2-15.

Source Habitats: Cover Type–Structural Stages

Of the eight Terrestrial Families that use forested cover type–structural stage combinations, all eight overlap with the dry forest potential vegetation group. However, Family 1 (the low elevation old forest species) is the one that can be identified most with the dry forest PVG, because 10 of the 15 cover type–structural stage combinations used by Family 1 come from the dry forest PVG. The remainder are from the riparian woodland PVG.

The dry forest PVG can include any of 50 different cover type–structural stage combinations in the project area. The dominant species that are found in the dry forest include: interior Douglas-fir, western larch, lodgepole pine, grand fir/white fir, shrub or herb/tree regeneration, Pacific ponderosa pine, interior ponderosa pine, and aspen. The cover types can be matched with eight different structural stages: old forest single story, old forest multi-story, unmanaged young forest, managed young forest, understory reinitiation, stem exclusion open canopy, stem exclusion closed canopy, and stand-initiation (Table 2-16).

Table 2-15. Terrestrial Communities and Status, Dry Forest.

Terrestrial Community	Status (Geographic Extent)
Early seral lower montane forest	Declined substantially
Early seral montane forest	Increased substantially
Late seral lower montane single story forest	Declined substantially
Late seral lower montane multi-story forest	Stayed constant
Late seral montane single story forest	Stayed constant
Late seral montane multi-story forest	Increased substantially
Mid seral lower montane forest	Increased somewhat
Mid seral montane forest	Increased substantially

Definition of status: declined substantially = current is less than 80% of historical extent; stayed constant = current is 95-105% of historical extent; increased somewhat = current is 105-120% of historical extent; increased substantially = current is more than 120% of historical extent.

Source: Hemstrom, et al. 1999

Some of the 50 cover type–structural stage combinations have expanded in extent since historical times, while others have shown a reduction in area. For instance, the dry forest PVG has seen a substantial reduction in ponderosa pine old forest single story structure since historical times. In some places, these forests have changed to cover types and structural stages such as Douglas-fir stem exclusion closed canopy, which is a mid seral vegetation community. The amount and direction of vegetation change depend on its location and scale. For example, across the project area, ponderosa pine old forest multi-story has declined substantially, but within some subwatersheds, watersheds, subbasins, and even ERUs that is not the case; in the Upper Klamath ERU ponderosa pine old forest multi-story structure increased by 88 percent (Wisdom et al. in press).

The cover type-structural stage combinations that are found in the dry forest are presented in Table 2-16. Nine of these cover type-structural stage combinations have declined substantially in geographic extent throughout their range since the historical period. The declines have been led by the losses in *ponderosa pine* old forest single story, old forest multi-story, stem exclusion closed canopy, and stand initiation stages. This is followed by *western larch* old forest multi-story and unmanaged young multi-story structures, and *lodgepole pine* unmanaged young multi-story structure. To a lesser extent, the stand-initiation stages of *interior Douglas-fir* and *western larch* have also declined substantially in geographic extent from the historical to current period. The biggest declines have been in the ponderosa pine cover type and the old forest, especially single story structure.

The cover type–structural stage combinations that have **increased** the most are mid seral stages such as *grand fir/white fir* understory reinitiation, and *ponderosa pine* managed young multi-story; grand fir/white fir old forest multi-story; and young forest stages such as *lodgepole pine* stand-initiation and *shrub/herb regeneration* open low-medium shrub. Cover type–structural stage combinations that have shown somewhat lesser increases since historical times are *interior Douglas-fir* old forest single story and multi-story structure and understory reinitiation; *ponderosa pine* unmanaged young multi-story and understory reinitiation; *lodgepole pine* understory reinitiation; *grand fir/white fir* old forest single story structure; *western larch* understory reinitiation and young unmanaged multi-story; and *shrub/herb regeneration.* For the most part, shifts have been to more shade-tolerant species and to mid seral stages.

Since the geographic extent of several of the Terrestrial Family 1 (low elevation old forest species) cover type–structural stage combinations in the dry forest have declined, it can be expected that the species in Family 1 are not faring well in the dry forest. The decreases in the dry forest cover type–structural stage combinations for Terrestrial Families 4 and 8 would suggest that Families 4 and 8 might be struggling in the dry forest as well.

It is more difficult to draw conclusions about the trends for the other forestland Terrestrial Families, since some of their source habitats are larger and some are smaller, geographically. It may be that these terrestrial species have shifted their use from young and old forests to middle aged forests in the dry forest potential vegetation group.

Table 2-16. Cover Type–Structural Stage Combinations, with Associated Terrestrial Families, Dry Forest Potential Vegetation Group.

Cover Type	Structural Stage	Terrestrial Community	Terrestrial Family
Exotic forbs/Annual grass	Closed herbland	exotic herbland	10
Fescue-bunchgrass	Open herbland[1]	upland herbland	5, 8, 10, 12
	Closed herbland[1]	upland herbland	5, 8, 10, 12
Grand fir/white fir	Old forest single story	late seral montane single	2, 3, 5, 6, 7
	Old forest multi	late seral montane multi	2, 3, 5, 6, 7
	Unmanaged young	mid seral montane	2, 3, 5, 6, 7
	Managed young	mid seral montane	3, 5, 7
	Understory reinitiation	mid seral montane	2, 3, 5, 6, 7
	Stem exclusion closed	mid seral montane	3, 5, 7
	Stand initiation	early seral montane	2, 3, 4, 5, 6, 7
Interior Douglas-fir	Old forest single story	late seral montane single	2, 3, 5, 6, 7
	Old forest multi	late seral montane multi	1, 2, 3, 5, 6, 7
	Unmanaged young	mid seral montane	2, 3, 5, 6, 7
	Managed young	mid seral montane	3, 5, 6, 7
	Understory reinitiation	mid seral montane	2, 3, 5, 6, 7
	Stem exclusion closed[1]	mid seral montane	3, 5, 6, 7
	Stand initiation	early seral montane	2, 3, 4, 5, 6, 7, 8
Interior ponderosa pine	Old forest single story[1]	late seral lower montane single	1, 2, 3, 5, 6, 7, 8
	Old forest multi[1]	late seral lower montane multi	1, 2, 3, 5, 6, 7
	Unmanaged young	mid seral lower montane	1, 2, 3, 5, 6, 7
	Managed young	mid seral lower montane	1, 3, 5, 6, 7
	Understory reinitiation	mid seral lower montane	2, 3, 5, 6, 7
	Stem exclusion open	mid seral lower montane	2, 5, 6, 7
	Stem exclusion closed[1]	mid seral lower montane	6, 7
	Stand initiation[1]	early seral lower montane	2, 3, 4, 5, 6, 7, 8, 10
Lodgepole pine	Old forest multi	late seral montane multi	2, 3, 5, 6, 7
	Unmanaged young	mid seral montane	2, 3, 5, 6, 7
	Managed young	mid seral montane	2, 3, 5, 7
	Understory reinitiation	mid seral montane	2, 3, 5, 7
	Stem exclusion closed	mid seral montane	3, 7
	Stand initiation[1]	early seral montane	2, 3, 4, 5, 7
Mountain big sagebrush	Closed low-med shrub	upland shrubland	5, 7, 10, 11
	Open low-med shrub[1]	upland shrubland	5, 7, 8, 10, 11, 12
Pacific ponderosa pine	Old forest single story	late seral lower montane single	1, 2, 3, 5, 6, 7, 8
	Old forest multi[1]	late seral lower montane multi	1, 2, 3, 5, 6, 7
	Unmanaged young	mid seral lower montane	2, 3, 5, 6, 7
	Managed young	mid seral lower montane	3, 5, 7
	Understory reinitiation	mid seral lower montane	2, 3, 5, 6, 7
	Stem exclusion closed[1]	mid seral lower montane	7
	Stand initiation	early seral lower montane	2, 3, 5, 6, 7, 8
Shrub/herb/tree regeneration	Open low-medium shrub	early seral montane	2, 3, 5
	Closed low-med shrub	early seral montane	2, 3, 5
	Closed herbland	early seral montane	2, 3, 5
Sierra Nevada mixed-conifer	Old forest single story	late seral montane single	1, 2, 3, 5, 6, 7
	Old forest multi[1]	late seral montane multi	1, 2, 3, 5, 6, 7
	Unmanaged young	mid seral montane	2, 3, 5, 6, 7
	Managed young	mid seral montane	3, 7
	Understory reinitiation[1]	mid seral montane	2, 3, 5, 7
	Stem exclusion closed[1]	mid seral montane	7
	Stand initiation	early seral montane	2, 3, 5, 7, 8

[1] These cover type–structural stages have declined substantially from the historical to current periods.

Source: Wisdom et al. (in press); Appendices 3A, 3B, 3F in Hann, Jones, Karl, et al. (1997).

Ponderosa pine forests historically were characterized as unbroken parklands of widely spaced tree clumps with a continuous understory of grasses and flowering plants.

Photo by USFS.

Dry forests currently have ponderosa pine being replaced by Douglas-fir and grand fir/ white fir.

Photo by Doug Basford.

Woodland PVG

Background

For the project area as a whole, the woodland PVG is relatively uncommon, making up about one percent of the area, both historically and currently. Roughly one-half of the woodland PVG is located on BLM- or Forest Service-administered lands (Table 3.18 in Hann, Jones, Karl, et al. 1997). Regionally within the project area, the woodland PVG is most prevalent in the Columbia Plateau, Blue Mountains, Central Idaho Mountains, Owyhee Uplands, and Upper Snake ERUs (see Table 3.45 in Hann, Jones, Karl, et al. 1997; and Maps 2-1, 2-5, and 2-6 earlier in this chapter).

The woodland PVG is typically located on edges of mesas, ridges, and knolls where fractured bedrock is near the surface and soil depths are shallow. These sites generally have low soil water availability due to the shallow soils. Consequently, herbaceous production is low. The restriction of woodlands to these sites has been attributed to fire exclusion (Burkhardt and Tisdale 1976, in Hann, Jones, Karl, et al. 1997). The woodland PVG is often located in the driest of the zones that would support conifer or broadleaved trees.

Table 2-17 shows the composition and structure of vegetation within the woodland potential vegetation group, and the associated Terrestrial Families.

Current Conditions and Trends

Currently the woodland PVG includes primarily upland woodlands and upland shrublands, with lesser amounts of early seral montane forest and exotic herblands. Representative tree species include western juniper, limber pine, mountain mahogany, and Oregon white oak, with representative shrub species including mountain big sagebrush and low sagebrush. Representative grass species include bluebunch wheatgrass, Sandberg bluegrass, and

Table 2-17. Cover Type–Structural Stage Combinations Within Terrestrial Communities and Associated Terrestrial Families, Woodland Potential Vegetation Group.

Terrestrial Community	Cover Type	Structural Stage	Terrestrial Family
Upland woodland	Juniper woodlands	Stand-initiation woodland	5, 6, 7, 8, 9, 10, 11
		Understory reinitiation woodland	5, 6, 7, 8, 9, 10, 11
		Young multi-story woodland	5, 6, 7, 8, 9, 10, 11
		Old multi-story woodland	5, 6, 7, 8, 9, 10, 11
		Old single-story woodland	5, 6, 7, 8, 9, 10, 11
	Limber pine	Stand-initiation forest	2, 5, 6, 7
		Stem exclusion open canopy forest	2, 5, 6, 7
		Understory reinitiation forest	2, 5, 6, 7
		Old multi-story forest	2, 5, 6, 7
Upland shrubland	Mountain mahogany	Closed low shrub	5, 6, 7, 9, 10, 11
		Open mid shrub[1]	5, 6, 7, 8, 9, 10, 11
	Mountain big sagebrush	Closed low shrub	5, 7, 10, 11
Upland herbland	Wheatgrass bunchgrass	Open herbland[1]	3, 5, 8, 10, 12
	Fescue-bunchgrass	Closed herbland[1]	5, 8, 10, 12
		Open herbland[1]	5, 8, 10, 12
Early seral montane forest	Shrub or herb/Tree regeneration	Closed mid shrub	2, 3, 5
Exotic herbland	Exotic forbs/Annual grass	Open herbland	10

[1] These cover type–structural stages have declined substantially from the historical to current periods.

Source: Appendices 3A, 3B, 3F in Hann, Jones, Karl, et al. (1997); and Wisdom et al. (in press).

bottlebrush squirreltail. Exotic herblands, commonly composed of such species as cheatgrass and medusahead, do not dominate the woodland PVG but could be found particularly on areas with disturbed soils and on areas subject to excessive livestock grazing pressure at some point in time.

Although there was no measurable change in geographic extent between historical and current for the woodland PVG, many of its constituent woodland cover types and structural stages encroached into other PVGs, such as the cool shrub and dry grass. In addition, within the woodland PVG itself, upland herblands transitioned into upland woodlands and/or upland shrublands (Table 3.30 in Hann, Jones, Karl, et al. 1997). The partial conversion of herbland to woodland and/or shrubland was the dominant change within the woodland PVG between historical and current. The decline in herblands and their constituent cover types (wheatgrass bunchgrass and fescue-bunchgrass) in the woodland PVG has contributed to the widespread decline observed in the project area for the wheatgrass bunchgrass and fescue-bunchgrass cover types (Appendix 5).

Fire-return intervals in the woodland PVG before Euroamerican settlement ranged from 5 to 150 years. Roughly 30 percent of fires then were lethal to the crowns of shrub and woodland species (that is, the upper vegetative layer). Between historical and current, fire regimes have shifted from roughly 30 percent to roughly 95 percent lethal. Fire-return intervals have lengthened to 75 to 150 years (see Maps 2-7 through 2-10 earlier in this chapter). The combination of lethal fires that occur less frequently means that fires in the woodland PVG have become more severe in their effects between historical and current.

Cool Shrub PVG

Background

Between historical and current, the geographic extent of the cool shrub PVG declined from nine percent to eight percent of the project area, representing an 11 percent decline. This decline in geographic extent of cool shrub PVG occurred primarily on non-BLM- or Forest Service-administered lands. Because of this, there was an increase in the proportion of the cool shrub PVG on BLM- and Forest Service-administered lands between historical and current, from slightly over one-half to two-thirds (57 to 66 percent) (Table 3.18 in Hann, Jones, Karl, et al. 1997). Regionally within the project area, the cool shrub PVG is most prevalent in the Owyhee Uplands, Columbia Plateau, Blue Mountains, Central Idaho Mountains, and Upper Snake ERUs, (see Table 3.45 in Hann, Jones, Karl, et al. 1997; and Maps 2-1, 2-5, and 2-6, earlier in this chapter).

The conversion of upland herbland and/or shrubland to upland woodland was the dominant change within the cool shrub potential vegetation group from historical to current periods.

Native plant communities of the cool shrub PVG tend to be diverse with many species of shrubs, grasses, forbs, and sedges. Representative shrub species include mountain big sagebrush, chokecherry, serviceberry, and rose species. Production of vegetation within the cool shrub PVG is limited by a short growing season and by low available water in the soil, attributable to either low rainfall or shallow, rocky, or clay soils. Soils of the cool shrub PVG generally indicate that they developed from a mixed shrub and grassland potential vegetation.

Table 2-18 shows the composition and structure of vegetation, and associated Terrestrial Families, within the cool shrub potential vegetation group.

Current Conditions and Trends

The conversion of upland herbland and/or upland shrubland to upland woodland was the dominant change within the cool shrub PVG between historical and current (Table 3.41 in Hann, Jones, Karl, et al. 1997). As mentioned in the woodland PVG section, many of the woodland cover types and structural stages within the woodland PVG encroached into the cool shrub PVG. The conversion of herblands and their constituent cover types (wheatgrass bunchgrass and fescue-bunchgrass) to woodlands in the cool shrub PVG has contributed to the widespread decline observed in the project area for the wheatgrass bunchgrass and fescue-bunchgrass cover types (Appendix 5). The conversion of shrublands and their constituent cover types (mountain big sagebrush and big sagebrush) to woodlands has contributed to the widespread decline observed in the project area for the mountain big sagebrush and big sagebrush cover types (Appendix 5). The greatest geographic extent of woodland encroachment into herblands and/or shrublands in the cool shrub PVG was attributable to

Table 2-18. Cover Type-Structural Stage Combinations Within Terrestrial Communities and Associated Terrestrial Families, Cool Shrub Potential Vegetation Group.

Terrestrial Community	Cover Type	Structural Stage	Terrestrial Family
Upland shrubland	Mountain big sagebrush	Closed mid shrub	5, 7, 10, 11
		Open mid shrub[1]	5, 7, 8, 10, 11, 12
	Big sagebrush	Closed mid shrub[1]	5, 7, 10, 11
		Open mid shrub[1]	5, 7, 8, 10, 11, 12
	Chokecherry/serviceberry/rose	Closed low shrub[1]	2, 3, 4, 5, 6, 11, 12
		Open low shrub	2, 3, 4, 5, 6, 8, 11, 12
		Open mid shrub	2, 3, 4, 5, 6, 8, 11, 12
		Open tall shrub	2, 3, 4, 5, 6, 11, 12
Upland woodland	Mixed-conifer woodlands	Stand-initiation woodland[1]	2, 3, 5, 6, 7, 8, 9, 10, 11
		Understory reinitiation woodland[1]	2, 3, 5, 6, 7, 8, 9, 10, 11
	Juniper/sagebrush	Stand-initiation woodland	5, 6, 7, 8, 9, 10, 11
		Understory reinitiation woodland	5, 6, 7, 8, 9, 10, 11
		Old single-story woodland	5, 6, 7, 8, 9, 10, 11
	Juniper woodlands	Old multi-story woodland	5, 6, 7, 8, 9, 10, 11
		Young multi-story woodland	5, 6, 7, 8, 9, 10, 11
Upland herbland	Wheatgrass bunchgrass	Open herbland[1]	3, 5, 8, 10, 12
		Closed herbland[1]	3, 5, 8, 10, 12
	Fescue-bunchgrass	Open herbland[1]	5, 8, 10, 12
		Closed herbland[1]	5, 8, 10, 12
Exotic herbland	Exotic forbs/Annual grass	Open herbland	10

[1] These cover type–structural stages have declined substantially from the historical to current periods.

Source: Appendices 3A, 3B, 3F in Hann, Jones, Karl, et al. (1997); and Wisdom et al. (in press).

western juniper, a relatively small- to medium-statured native tree of the Pacific Northwest.

Since the late 1800s, and more specifically since the 1880s on Steens Mountain (Miller and Rose 1995) in the Northern Great Basin ERU (Southeast Oregon RAC), western juniper has increased in density and distribution. While western juniper at historical times was relegated to either relatively open, savannah-like woodlands, which were maintained by relatively frequent fires, or to rocky surfaces and ridges, western juniper from historical to current has expanded not only into mountain big sagebrush, but also into the dry shrub PVG (for example low sagebrush) and the riparian woodland PVG (for example, quaking aspen, and other riparian vegetative types).

As western juniper woodlands increase in density, understory vegetation production declines. Conversely, after reduction of western juniper density, site productivity of understory species typically increases. However, undesirable species, especially cheatgrass and noxious weeds such as medusahead, knapweed, and leafy spurge, increase after juniper removal if they were present before removal.

Healthy western juniper woodlands, with a full complement of understory non-vascular species (for example, species composing biological crusts), grasses, forbs, and shrubs, represent one of the most diverse plant communities in the project area. However, biodiversity is reduced on sites where western juniper has increased in density to the point that understory vegetation is excluded. Therefore, the expansion and increasing density of western juniper within native plant communities poses a threat to plant species in the understory and other species that depend on the habitat within those communities.

Western juniper expansion also has affected hydrologic processes. Western juniper intercepts rain and snow with its canopy, which results in less water reaching the soil surface, especially in low intensity

storm events. On sites where western juniper has excluded understory vegetation, particularly in spaces between canopies, infiltration has probably declined and runoff and erosion have probably increased, especially under high intensity storm events. The hydrological effects of western juniper increase are difficult to separate from those resulting from excessive livestock grazing pressure, but where excessive livestock grazing pressure has contributed to the decline in understory vegetation it has probably contributed to increased runoff and erosion as well.

Fire frequency and severity in the cool shrub PVG has changed between historical and current (see Maps 2-7 through 2-10, earlier in this chapter), attributable greatly to the invasion and increasing density of woodlands, which itself has been caused at least partially by excessive livestock grazing pressure. The increasing density of woodland species can cause deep litter and duff layers beneath the tree canopies, which are flammable. However, particularly in woodlands with a high canopy cover, herbaceous fuel is lacking beneath and between canopies. The result is that these woodlands tend to burn less frequently, but when fire does occur, the effects are more severe.

Subdominant changes in the cool shrub PVG between historical and current, apparent regionally rather than project-area-wide, were the conversion of upland herbland to upland shrubland, and the conversion of upland herbland and upland shrubland to exotic herbland (that is, exotic undesirable plant species). Mountain big sagebrush was the primary contributor to the conversion of herbland to shrubland. Conversion of herbland to shrubland within the cool shrub PVG was most notable within the Central Idaho Mountains and Owyhee Uplands ERUs, corresponding to the Lower Snake RAC and Southeast Oregon RAC (Tables 3.59, 3.95 in Hann, Jones, Karl, et al. 1997; Map 2-1). Conversion of herbland and/or shrubland to exotic herbland was most notable within the Blue Mountains and Central Idaho Mountains ERUs, (Tables 3.51, 3.59 in Hann, Jones, Karl, et al. 1997; Map 2-1). Problematic exotic plants were cheatgrass, medusahead, whitetop, spotted knapweed, and leafy spurge. The conversion of herblands and their constituent cover types (wheatgrass bunchgrass and fescue-bunchgrass) to shrublands and exotic herblands in the cool shrub PVG has contributed to the widespread decline observed in the project area for the wheatgrass bunchgrass and fescue-bunchgrass cover types (Appendix 5). The conversion of shrublands and their constituent cover types (mountain big sagebrush and big sagebrush) to exotic herblands has contributed to the widespread decline observed in the project area for the mountain big sagebrush and big sagebrush cover types (Appendix 5).

Dry Grass PVG

Background

Between historical and current, the geographic extent of the dry grass PVG declined from 9 percent to 4 percent of the project area, representing a 56 percent decline. This decline in geographic extent of dry grass PVG occurred primarily on non-BLM- or Forest Service-administered lands. Because of this, there was an increase in the proportion of the dry grass PVG on BLM- and Forest Service-administered lands between historical and current, from only one-fifth to nearly one-half (20 to 44 percent) (Table 3.18 in Hann, Jones, Karl, et al. 1997). Regionally within the project area, the dry grass PVG is most prevalent in the Blue Mountains, Central Idaho Mountains, Upper Clark Fork, Columbia Plateau, and Snake Headwaters ERUs (see Table 3.45 in Hann, Jones, Karl, et al. 1997; and Maps 2-1, 2-5, and 2-6, earlier in this chapter).

The dry grass PVG includes primarily native grasslands, with lesser amounts of woodlands (dominated by conifers such as ponderosa pine and Douglas-fir), seeded grasslands (whether seeded with native grasses or desirable exotic grasses), and cropland-hay-pasture (whether grass such as wheat, or forb such as alfalfa). Native plant communities are diverse, with grasses being dominant, but numerous forbs and sedges are present. Representative grass species of the dry grass PVG include the native grasses bluebunch wheatgrass, Idaho fescue, Sandberg bluegrass, bottlebrush squirreltail, and Great Basin wildrye, as well as exotic grasses such as crested wheatgrass, intermediate wheatgrass, and Kentucky bluegrass. In the absence of fire, shrubs and trees eventually invade the dry grass PVG, particularly where the dry grass PVG is adjacent to the dry shrub, woodland, or dry forest PVGs.

Production of vegetation within the dry grass PVG depends greatly on precipitation received during the fall–winter and winter–spring periods, which are the periods of greatest precipitation where the dry grass PVG is located. Summers are typically dry. Dry grass PVG vegetation has adapted to periodic drought. During a 100-year period from 1895 through 1994, the dry grass PVG has experienced more frequent drought periods (years in which less than 75 percent of fall–winter or winter–spring precipitation is received) than wet periods (two or more successive years of greater than 110 percent of fall–winter or winter–spring precipitation, believed to be critical for perennial plant recruitment).

Table 2-19 shows the composition and structure of vegetation within the dry grass potential vegetation group, and the associated Terrestrial Families.

Current Conditions and Trends

A dominant change within the dry grass potential vegetation group was the conversion of upland herbland to exotic herbland through the invasion and spread of exotic undesirable plants. Fires in the dry grass PVG have become more severe in their effects.

Regardless of whether the dry grass PVG was on BLM- or Forest Service-administered lands or not, a dominant change within the dry grass PVG between historical and current was the conversion of upland herbland to exotic herbland through the invasion and spread of exotic undesirable plants (including noxious weeds) (Table 3.39 in Hann, Jones, Karl, et al. 1997). Exotic undesirable plants were common within most cover types of the dry grass PVG. Although the most problematic exotic plants within the dry grass PVG varied regionally within the project area, some of the most notable include yellow starthistle, spotted knapweed, dalmatian toadflax, and cheatgrass. With the exception of the agricultural PVG, the dry grass PVG was the most susceptible to exotic plant invasion of all the PVGs in the project area. The conversion of herblands and their constituent cover types (wheatgrass bunchgrass and fescue-bunchgrass) to exotic herblands in the dry grass PVG has contributed to the widespread decline observed in the project area for the wheatgrass bunchgrass and fescue-bunchgrass cover types (Appendix 5).

Another dominant change within the dry grass PVG between historical and current was a decline within the upland herblands in the dominance of native bunchgrasses, such as bluebunch wheatgrass and Idaho fescue. With the decline in dominance of these native bunchgrasses came an increase in dominance of smaller-statured bunchgrasses such as Sandberg bluegrass, an increase in exotic undesirable plants as already mentioned, and an increase in exotic seeded grasses (such as crested wheatgrass).

Fire-return intervals in the dry grass PVG before Euroamerican settlement ranged from 5 to 75 years. The majority of these fires were nonlethal, meaning that the herbaceous vegetation cycled back after the

Table 2-19. Cover Type-Structural Stage Combinations Within Terrestrial Communities and Associated Terrestrial Families, Dry Grass Potential Vegetation Group.

Terrestrial Community	Cover Type	Structural Stage	Terrestrial Family
Upland herbland	Wheatgrass bunchgrass	Open herbland[1]	3, 5, 8, 10, 12
		Closed herbland[1]	3, 5, 8, 10, 12
	Fescue-bunchgrass	Open herbland[1]	5, 8, 10, 12
		Closed herbland[1]	5, 8, 10, 12
	Native forb	Open herbland	5, 8, 10, 12
		Closed herbland	5, 8, 10, 12
Upland woodland	Mixed-conifer woodlands	Stand-initiation woodland[1]	2, 3, 5, 6, 7, 8, 9, 10, 11
		Stem exclusion woodland[1]	2, 3, 5, 6, 7, 8, 9, 10, 11
		Young multi-story woodland[1]	2, 3, 5, 6, 7, 8, 9, 10, 11
		Old multi-story woodland[1]	2, 3, 5, 6, 7, 8, 9, 10, 11
Agricultural	Cropland/hay/pasture	Closed herbland	NA
Exotic herbland	Exotic forbs/annual grass	Open herbland	10
		Closed herbland	10

Abbreviations used in this table:
NA - none reported for this cover type-structural stage in Wisdom et al. (in press).

[1] These cover type–structural stages have declined substantially from the historical to current periods.

Source: Appendices 3A, 3B, 3F in Hann, Jones, Karl, et al. (1997); and Wisdom et al. (in press).

fire. Mixed-fire events, meaning fires that were a mixture of non-lethal and lethal (that is, burning the upper vegetative layer of shrubs and/or trees), occurred on roughly 10 percent of the dry grass PVG. Mixed-fire events typically occurred where shrub or woodland cover types existed within the dry grass PVG, or in herb-dominated areas that had high accumulations of litter and decadent plants. Fire-return intervals lengthened between historical and current, from 5 to 75 years to 25 to 75 years (see Maps 2-7 through 2-10, earlier in this chapter). In addition, more fires currently are of the mixed-regime compared with historical regimes, because of fire suppression. The combination of increased prevalence of lethal fires that occur less frequently means that fires in the dry grass PVG have become more severe in their effects between historical and current periods.

Dry Shrub PVG

Background

Between historical and current, the geographic extent of the dry shrub PVG declined from 30 percent to 21 percent of the project area, representing a 30 percent decline. This decline in geographic extent of dry shrub PVG occurred primarily on non-BLM-/Forest Service-administered lands. Because of this, there was an increase in the proportion of the dry shrub PVG on BLM- and Forest Service-administered lands between historical and current, from nearly one-half to two-thirds (46 to 65 percent) (Table 3.18 in Hann, Jones, Karl, et al. 1997). Regionally within the project area, the dry shrub PVG is most prevalent in the Northern Great Basin, Owyhee Uplands, Upper Snake, Columbia Plateau, Blue Mountains, and Central Idaho Mountains ERUs (Table 3.45 in Hann, Jones, Karl, et al. 1997; and Maps 2-1, 2-5, and 2-6 earlier in this chapter).

The dry shrub PVG includes primarily native shrublands, with lesser amounts of exotic herblands, seeded grasslands (whether seeded with native grasses or desirable exotic grasses), native grasslands, and woodlands. Native plant communities are diverse, with shrubs being dominant, but numerous grasses and forbs are present. Representative shrub species of the dry shrub PVG include Wyoming big sagebrush, Basin big sagebrush, low sagebrush, antelope bitterbrush, shadscale, winterfat, and greasewood. Representative grass species of the dry shrub PVG include the native grasses bluebunch wheatgrass, bottlebrush squirreltail, Thurber needlegrass, and Sandberg bluegrass; and seeded exotic grasses such as crested wheatgrass and intermediate wheatgrass. The periodicity of fire maintained a shifting mosaic of herblands and shrublands within the dry shrub PVG. In the absence of fire, trees such as western juniper invaded the dry shrub PVG, particularly where the dry shrub PVG was adjacent to the woodland PVG or the dry forest PVG.

Production of vegetation within the dry shrub PVG depends greatly on precipitation received during the fall–winter and winter–spring periods, which are the periods of greatest precipitation where most of the dry shrub PVG is located.

Production of vegetation within the dry shrub PVG depends greatly on precipitation received during the fall–winter and winter–spring periods, which are the periods of greatest precipitation where most of the dry shrub PVG is located. Summers are typically dry. Dry shrub PVG vegetation has adapted to frequent drought. During a 100-year period from 1895 through 1994, dry shrub PVG areas have experienced more frequent drought periods (years in which less than 75 percent of fall-winter or winter-spring precipitation is received) than wet periods (two or more successive years of greater than 110 percent of fall–winter or winter–spring precipitation, believed to be critical for perennial plant recruitment). Compared with the dry grass PVG, the dry shrub PVG receives less annual rainfall, and experiences greater drought frequency and frequency of wet periods. Therefore, not only is the dry shrub PVG drier than the dry grass PVG, but the amount of rainfall it receives from year to year is more variable.

Table 2-20 shows the composition and structure of vegetation in the dry shrub potential vegetation group and the associated Terrestrial Families.

Current Conditions and Trends

Similar to the dry grass PVG, a dominant change within the dry shrub PVG between historical and current was the conversion of upland herbland and upland shrubland to exotic herbland through the invasion and spread of exotic undesirable plants (including noxious weeds) (table 3.40 in Hann, Jones, Karl, et al. 1997). This change was evident both on BLM- and Forest Service-administered lands and on

Table 2-20. Cover Type-Structural Stage Combinations Within Terrestrial Communities and Associated Terrestrial Families, Dry Shrub Potential Vegetation Group.

Terrestrial Community	Cover Type	Structural Stage	Terrestrial Family
Upland shrubland	Antelope bitterbrush/bluebunch wheatgrass	Closed low shrub[1]	3, 5, 7, 10, 11
	Big sagebrush	Closed low shrub[1]	5, 7, 10, 11
		Open low shrub[1]	5, 7, 8, 10, 11, 12
		Closed herbland[1]	5, 8, 10, 11, 12
	Salt desert shrub	Closed low shrub	5, 7, 10, 11
		Open low shrub	5, 7, 10, 11
	Low sagebrush	Open low shrub	5, 7, 8, 10, 11, 12
Upland woodland	Juniper woodlands	Stand-initiation woodland	5, 6, 7, 8, 9, 10, 11
		Understory reinitiation woodland	5, 6, 7, 8, 9, 10, 11
		Young multi-story woodland	5, 6, 7, 8, 9, 10, 11
		Old multi-story woodland	5, 6, 7, 8, 9, 10, 11
	Juniper/sagebrush	Stand-initiation woodland	5, 6, 7, 8, 9, 10, 11
		Understory reinitiation woodland	5, 6, 7, 8, 9, 10, 11
		Old single-story woodland	5, 6, 7, 8, 9, 10, 11
Upland herbland	Wheatgrass bunchgrass	Closed herbland[1]	3, 5, 8, 10, 12
		Open herbland[1]	3, 5, 8, 10, 12
	Fescue-bunchgrass	Closed herbland[1]	5, 8, 10, 12
		Open herbland[1]	5, 8, 10, 12
Exotic herbland	Exotic forbs/annual grass	Closed herbland	10
		Open herbland	10

[1] These cover type–structural stages have declined substantially from the historical to current periods.

Source: Appendices 3A, 3B, 3F in Hann, Jones, Karl, et al. (1997); and Wisdom et al. (in press).

non-BLM-/Forest Service-administered lands. Exotic undesirable plants were common within most cover types of the dry shrub PVG, with the most common being cheatgrass. Other problematic exotic plants within the dry shrub PVG varied regionally within the project area, with some of the most notable being rush skeletonweed, medusahead, whitetop, and diffuse knapweed. The conversion of herblands and their constituent cover types (wheatgrass bunchgrass and fescue-bunchgrass) to exotic herblands in the dry shrub PVG has contributed to the widespread decline observed in the project area for the wheatgrass bunchgrass and fescue-bunchgrass cover types (Appendix 5). The conversion of shrublands and the following constituent cover types (antelope bitterbrush/bluebunch wheatgrass and big sagebrush) to exotic herblands has contributed to the widespread decline observed in the project area for the antelope bitterbrush/bluebunch wheatgrass and big sagebrush cover types (Appendix 5). The greatest geographic extent of shrubland conversion to exotic herbland was attributable to cheatgrass. See the Factors of Influence section of this chapter for more detailed information on cheatgrass.

Another dominant change within the dry shrub PVG between historical and current was the conversion of upland herbland to upland shrubland (table 3.40 in Hann, Jones, Karl, et al. 1997). This change, too, was evident both on BLM- and Forest Service-administered lands and on non-BLM- and Forest Service-administered lands. The conversion of herblands and their constituent cover types (wheatgrass bunchgrass and fescue-bunchgrass) to shrublands in the dry shrub PVG has contributed to the widespread decline observed in the project area for the wheatgrass bunchgrass and fescue-bunchgrass cover types (Appendix 5).

Conversion to agriculture was the greatest contributor to the decline in geographic extent of the dry shrub, dry grass, coolshrub, and riparian shrub PVGs.

A subdominant change within the dry shrub PVG, apparent regionally in the Upper Klamath ERU (corresponds best to the Klamath PAC), was a conversion of upland shrublands to upland woodlands. Western juniper (juniper-sagebrush cover type) encroached into the low sagebrush cover type.

Fire, interacting with livestock grazing, played a major role in these changes. Cheatgrass was the major contributor to the conversion of upland herbland and upland shrubland to exotic herbland. The flammability of cheatgrass caused a greater frequency of fire that led to decline of upland shrublands and herblands. Conversely, lack of fire was responsible for the conversion of upland herbland to upland shrubland. See the Factors of Influence section of this chapter for more detail on wildfire frequency and severity.

Agricultural PVG

Between historical and current, the geographic extent of the agricultural PVG increased from zero to 17 percent of the project area. This increase, as expected, occurred almost totally on non-BLM- or Forest Service-administered lands. The agricultural PVG is located primarily in areas that were dry shrub, dry grass, cool shrub, and riparian shrub PVGs historically. Hence, conversion to agriculture was the greatest contributor to the decline in geographic extent of the dry shrub, dry grass, cool shrub, and riparian shrub PVGs (Table 3.18 in Hann, Jones, Karl, et al. 1997). Regionally within the project area, the agricultural PVG is most prevalent in the Columbia Plateau, Northern Glaciated Mountains, Blue Mountains, Owyhee Uplands, and Upper Snake ERUs (see Maps 2-1, 2-5, 2-6, earlier in this chapter).

Table 2-21 shows the composition and structure of vegetation in the agricultural potential vegetation group and the associated Terrestrial Families.

Table 2-21. Cover Type-Structural Stage Combinations Within Terrestrial Communities and Associated Terrestrial Families, Agricultural Potential Vegetation Group.

Terrestrial Community	Cover Type	Structural Stage	Terrestrial Family
Agricultural	Cropland/hay/pasture	Closed herbland	NA
		Agricultural	NA
Upland herbland	Fescue-bunchgrass	Closed herbland[1]	5, 8, 10, 12
		Open herbland[1]	5, 8, 10, 12
Urban	Urban	Urban	NA

Abbreviations used in this table:
NA - none reported for this cover type-structural stage in Wisdom et al. (in press).

[1] These cover type–structural stages have declined substantially from the historical to current periods.

Source: Appendices 3A, 3B, 3F in Hann, Jones, Karl, et al. (1997); and Wisdom et al. (in press).

Terrestrial Species Component

Key Terms Used in This Section

Broad-scale species —Those species whose source habitats could be mapped reliably using a block size of at least 247 acres (100 hectares).

Ecological significance — In the *Scientific Assessment* and this EIS, refers to a specific method of judging the significance of changes (from historical) of cover types and terrestrial community types, based on class changes, regional changes, and departure indices. See Hann, Jones, Karl, et al. (1997, page 409) for details.

Emergent trees — Live or dead trees that are taller than the overall stand and thus emerge above it. Emergent trees are important to many wildlife species that use forest stand-initiation structural stages.

Fine-scale species —Those species whose source habitats could not be mapped reliably using a block size of at least 247 acres (100 hectares).

Source habitat —The composite of vegetation characteristics that contribute to terrestrial species population maintenance or growth in a specified time and space. Source habitats are described in Wisdom et al. (in press) using dominant vegetation cover type and structural stage combinations that can be estimated reliably at the 247-acre (100-hectare) patch scale. Various combinations of these cover type–structural stages make up the source habitats for the terrestrial species discussed in this EIS, and provide the range of vegetation conditions required by these species for food, reproduction, and other needs.

Special status species — Federally listed threatened or endangered species, federal proposed or candidate species, and species managed as sensitive species by the Forest Service and/or BLM.

Species-seasonal combinations — Represents a species and the season of year (summer, winter, or year-long) that it uses source habitat. It also indicates that some species may migrate within or outside the project area. For example: blue grouse use forest mosaic habitat (Family 3) in the summer and broad elevation old forests (Family 2) in the winter.

Terrestrial Family —An aggregate of groups of broad-scale terrestrial vertebrate species of focus for ICBEMP, organized into "families" based on habitat requirements (Wisdom et al. in press). Twelve Terrestrial Families were identified.

Terrestrial Group —Terrestrial vertebrate species of focus for ICBEMP, organized into groups based on habitat requirements (Wisdom et al. in press). Forty Terrestrial Groups are discussed in this EIS.

Vascular plant —A plant that has specialized tissues, which conduct nutrients, water, and sugars, along with other specialized parts such as roots, stems, and reproductive structures. Vascular plants include ferns, flowers, grasses, shrubs, trees, and many others.

Widely distributed species —Those species that occur on more than one administrative unit. Widely distributed species may be fine-scale or broad-scale based on habitat resolution; however, in this EIS, it was only possible to disclose specific quantitative effects of the alternatives on widely distributed species whose habitat could be reliably mapped using a block size of at least 247 acres.

Summary of Conditions and Trends

- Approximately 14,000 terrestrial plant and animal species were considered in the Terrestrial Ecology Assessment, including 548 vertebrates, 715 invertebrates, and more than 12,500 plant species. The Supplemental Draft EIS focuses on 91 terrestrial species (a total of 97 "species-seasonal combinations") that are of broad-scale concern and whose habitat could be mapped reliably using available broad-scale data.
- From historical to current periods, there has been an increase in fragmentation and loss of connectivity within and between blocks of habitat, especially in lower elevation forests, shrub steppe, and riparian areas in the interior Columbia River Basin. Fragmentation has isolated some animal and plant habitats and populations and reduced the ability of populations to disperse across the landscape, resulting in potential, long-term loss of genetic interchange.
- Declines in plant and animal terrestrial species are due to a number of human causes including: conversion of habitat to agriculture and urban development, grazing, timber harvest, introduction of exotic plant and animal species, recreation, high road densities, fire exclusion and fire suppression, and mining.
- Biological crusts have been degraded and their development has been inhibited in some rangeland cover types by recreational activities, excessive livestock grazing pressure, and exotic undesirable plant invasions. Degradation of biological crusts and inhibition of biological crust development often causes and perpetuates an increase in soil erosion.
- A general downward trend in habitat has been documented for most of the species-seasonal combinations analyzed for this project. The degree to which source habitats have declined is generally consistent across the project area. Even those species-seasonal combinations that have not declined more than 20 percent, when looking at the basin as a whole, do show greater declines in some areas.
- In total: 76 species-seasonal combinations have a downward trend for habitat. Habitats for 12 of the species-seasonal combinations have declined more than 50 percent; 43 have declined more than 20 percent.
- Four species-seasonal combinations have essentially a stable trend for habitat.
- Seventeen species-seasonal combinations have an increasing trend for habitat. Habitats for one species-seasonal combination have increased more than 20 percent, and habitats for five have increased more than 50 percent.
- Currently, less than 10 percent of the project area provides habitat for 14 of the species-seasonal combinations.
- Fifty-three cover type–structural stages have declined substantially in geographic extent from the historical to current period. Most of these source habitats (41 out of 53) are especially important to the species in the following Terrestrial Families: low elevation old forest, broad elevation old forest, early seral montane and lower montane forest, sagebrush, grassland, and open canopy sagebrush.

Introduction

From historical to current periods, there has been an increase in fragmentation and loss of connectivity within and between blocks of habitat, especially in lower elevation forests, shrub steppe, and riparian areas in the interior Columbia Basin.

The vast number of terrestrial species in the interior Columbia River Basin makes it a challenge to understand the regional ecology and evaluate the implications of proposed land management scenarios. Approximately 14,000 terrestrial plant and animal species were considered in the Terrestrial Ecology Assessment (Marcot et al. 1997), of which 548 are vertebrates (132 mammals, 362 birds, 27 reptiles, 27 amphibians). Approximately 715 invertebrates and more than 12,500 plant species were considered (see Table 2-22).

The Terrestrial Ecology Assessment (Marcot et al. 1997) compared prehistoric, historical, and current terrestrial environments and plant and animal communities and looked closely at habitat changes that would affect terrestrial species.

Changes in vegetation composition, distribution and structure, climate, water availability and quality, soil characteristics, and human disturbance may all affect the habitats of terrestrial species. The degree to which any species is affected depends on the magnitude of the changes, the ability of the species to move to other blocks of the same habitat or other habitats types, the distribution and interconnections of populations of species, the sensitivity of these species or their habitats to human activity, and many other factors that are not always well understood. Populations can increase or decrease because of habitat changes that affect their distribution, density, access to habitat, or a combination of all three. Thus, what may be harmful to one species may benefit or not affect another species, or may affect the ways that terrestrial species interact with each other (Marcot et al.1997).

From historical to current periods, there has been an increase in fragmentation and loss of connectivity within and between blocks of habitat, especially in lower elevation forests, shrub steppe, and riparian areas in the interior Columbia Basin. Fragmentation has isolated some animal and plant habitats and populations and reduced the ability of populations to disperse across the landscape, resulting in potential, long-term loss of genetic interchange.

Increasing human population in the project area has resulted in an increase in access and human activities. These uses can increase terrestrial species displacement and vulnerability to mortality, fragment habitat, and allow for access of exotic plants into new locations. In some places road density has increased to the point where some species will leave the area to avoid human activity.

Table 2-22. Terrestrial Species Considered in the Scientific Assessment.

Type	Total # of Species Considered	Federally Listed			FS/BLM	
		Threatened	Endangered	Proposed	Candidate	Sensitive
Invertebrates	715[1]	1	5	0	0	23
Amphibians	27[2]	0	0	0	2	10
Reptiles	27	0	0	0	0	4
Birds	362[3]	1	1	0	0	66
Mammals	132	1	2	2	1	19
Plants	12,625[4]	4	3	1	7	700

[1] Number of species considered; the estimated number of invertebrates in the Assessment Area is more than 24,000.
[2] The spotted frog (*Rana pretiosa*) was separated into two species: the Oregon spotted frog (*Rana pretiosa*) and the Columbia spotted frog (*Rana lutevenis*) since the Draft EISs were prepared.
[3] Number includes 79 species which are accidental or casual species.
[4] Number of species considered; the estimated number of plants in the Assessment Area is approximately 19,000.

Source: Marcot et al. 1997. Sensitive Lists (see Appendix 6).

Changes from the Draft EISs

Terrestrial Species

Organization and Species Discussed

Information on terrestrial species in Chapter 2 of the Draft EISs was presented separately for each potential vegetation group (dry, moist, cold forest; dry grass, dry and cool shrub PVGs). Information was organized by taxonomic classification: plants (vascular, non-vascular), invertebrates, and vertebrates (amphibians, reptiles, birds, mammals). Information on biological crusts was presented in the Rangelands section of the Draft EISs.

Information on terrestrial species in this Supplemental Draft EIS is organized by taxonomic classification, undifferentiated by potential vegetation group, to provide overview and context. Information on biological crusts is presented as part of the plants discussion. The section on terrestrial vertebrates includes discussion of terrestrial source habitats for 91 species, based on the work developed by Widsom et al. (in press) after the Draft EISs were published. Of the 91 species under consideration in the Supplemental Draft EIS, approximately 27 were not included in the Draft EISs, and approximately 35 species that were discussed in the Draft EISs are not discussed here. This new analysis focuses on terrestrial vertebrate species habitats that might require further assessment and management at the broad scale.

Endemic Species

The Draft EISs presented maps and discussions of endemic species, as examples of species that may require special management emphasis to achieve their long-term evolutionary potential. Because endemic species are generally restricted to small portions of the project area and are best evaluated at finer scales, information on endemic species in the Supplemental Draft EIS has been condensed.

Northern Spotted Owl, Marbled Murrelets, and Peregine Falcon

The project area was adjusted for the Supplemental Draft EIS to exclude the area covered by the Northwest Forest Plan (see Chapter 1). This excludes habitat for northern spotted owls and marbled murrelets; therefore, these species are not discussed in the Supplemental Draft EIS. Also, the peregrine falcon was recently delisted by the U.S. Fish and Wildlife Service, and is now a Forest Service/BLM sensitive species.

Terrestrial habitat trends are not meant to be interpreted necessarily as trends in population size for individual species. In part this is because abundance of a species can be affected by factors other than habitat quality, quantity, or distribution. For example, even if habitat remains constant, climatic conditions during breeding or wintering may cause a change in a species population size or density. However, local habitat changes are still key to the potential to maintain sustainable populations.

Information in this section is presented by taxonomic classification of plants (non-vascular and vascular) and animals (invertebrates and vertebrates) to provide an overview of species and habitats under consideration in this EIS. This discussion parallels the information found in Chapter 2 of the Draft EISs. With the refined focus of this Supplemental Draft EIS, there is no longer specific direction in Chapter 3 for invertebrates, amphibians, or other fine-scale species. However the discussion remains in Chapter 2 for completeness of information and consistency with science.

The discussion of terrestrial vertebrates includes new information on source habitats, derived from Wisdom et al. (in press), which was completed after the Draft EISs were published. Following this are discussions on riparian/wetland vertebrate species, other habitat considerations, special status species, harvestability considerations, and viability considerations. Discussions of riparian- or wetland-dependent species are presented in this section to keep information about terrestrial species together. However, a more detailed discussion of riparian and wetland vegetation types is found in the Aquatic/Riparian/Hydrologic section of this chapter.

Terrestrial Integrity Considerations

In the Draft EISs three concepts developed by the Science Team to account for terrestrial integrity were presented: species viability, long-term evolutionary potential, and multiple ecological scales and evolutionary time frames. The second and third concepts concern rare or endemic species or species at the edges of their range. They are less applicable in the Supplemental Draft EIS because they deal with species that are better evaluated at finer scales even though some benefits are anticipated from this project. Viability of broad-scale species of concern is the concept focused on in this Supplemental Draft EIS.

A list of terrestrial species was reviewed by expert panels (see Appendix 6). From this list, broad-scale and fine-scale species of concern were identified (see Lehmkuhl et al. 1997 and Wisdom et al. in press). Effects of the alternatives will be disclosed for species with a viability concern, as determined by the science panels.

Plants

The plant discussion was derived from Marcot et al. (1997) unless otherwise indicated. That publication contains additional information on the species groups discussed below.

The project area is known to support more than 12,500 plant species (Table 2-22, earlier in this section), including more than 8,000 vascular plants and over 4,500 species of non-vascular plants (bryophytes) and plant allies (lichens and fungi).

This richness in plant diversity is a reflection of the many different habitats found within the interior Columbia Basin, ranging from alpine to desert conditions with a variety of bedrock types, soils, and temperature and moisture regimes. Plants are primary producers, organisms that convert the energy of the sun into food and nutrients for other living organisms, making them a critical component in the maintenance of ecosystems. Commercial resources critical to the region's economy are provided by plants, including trees, forage, and other special plant products.

Many groups of plants and related organisms play multiple, but poorly understood, roles in functional ecosystems. Different levels of information are available for each of the plant groups. The vast majority of available information relates to vascular plant species (especially those that are economically valuable) although nonvascular plants and plant allies often play critical roles in ecosystems.

Non-vascular Plants and Plant Allies

Bryophytes

Bryophytes are non-vascular plants, lacking specialized tissues for conducting nutrients and water. Bryophytes include mosses, liverworts, and hornworts. More than 800 species of bryophytes are known to occur in the project area, approximately 40 percent of which appear to be rare or endemic. Bryophytes are found on a range of substrates, including wet or alkaline soils, rocks, peatlands, geothermal areas, and decaying wood. They are important sources of food and shelter for vertebrates and invertebrates. Biological (microbiotic) crusts in rangelands consist of both bryophytes and lichens, covering and protecting the area between grass clumps and/or shrubs from erosion (see discussion below). Terrestrial bryophytes are affected when their substrate or associated microclimate is modified. For riparian and aquatic species, changes in water quality are important determinants of population health and viability.

Fungi

A key role of fungi in ecosystems is that of decomposer, recycling nutrients within an ecosystem to make them available for use by other organisms. Many species of fungi facilitate moisture and nutrient absorption by plants through beneficial, mycorrhizal, relationships with plant roots. Many fungi are important food items for a range of vertebrates and invertebrates. Other fungi in the project area are of commercial value and economic importance. Many of the known species appear to be local or regional endemics.

Lichens

Lichens, which are organisms made up of algal and fungal components, are represented by more than 1,000 species within the project area. Lichens function in a wide variety of ecosystems as food sources for animals, and they contribute organic matter to forest and rangeland soils. Some lichens are used as food and dyes by American Indians, while others are thought to have medicinal qualities. Lichens are a key component of biological crusts in rangeland environments (see next section). Lichens are affected when their substrate (for example, wood, soil, rock) is modified through community successional changes, timber harvests, livestock grazing, fire and invasive plant species. Artificially dense forest stands create unsuitable habitat for most lichen species.

Biological Crusts

Biological crusts consist of lichens, bryophytes, algae, microfungi, cyanobacteria, and bacteria growing on or just below the soil surface (Eldridge and Greene 1994). Biological crusts play a role in soil stability, nutrient cycling, and soil moisture, and in interactions with vascular plants. Lichens and algae provide forage for invertebrates, and some lichens provide forage for big game species during critical winter periods (Thomas and Rosentreter 1992). The ecological role of biological crusts is probably most substantial in arid ecosystems in which above-ground productivity is inherently low. Cover types in the project area that can be associated with substantial biological crust development include: salt desert shrub, low sagebrush, big sagebrush, and juniper woodland. (See Appendix 13 for additional information on biological crusts.)

In some areas biological crusts can account for 70 to 80 percent of the living cover (Belnap 1990). Biological crusts contribute to aggregate structure, and thus soil stability, by binding soil particles (Belnap and Gardner 1993; Campbell et al. 1989; Danin et al. 1989; Danin and Yaalon 1980; Graetz and Tongway 1986; Schulten 1985). The resulting surface roughness reduces water velocity and associated erosion and creates ponding that enhances sediment deposition (Alexander and Calvo 1990; Brotherson et al. 1983). Soils stabilized by biological crusts tend to have greater concentrations of organic material, nitrogen, exchangeable manganese, calcium, potassium, magnesium, and available phosphorus (Harper and Pendleton 1993). However, the availability of the nitrogen that is fixed by biological crusts, and its necessity to vascular plants and community structure and function, continue to be unresolved issues (Evans and Ehleringer 1994; Harper and Pendleton 1993; Rychert et al. 1978; Snyder and Wullstein 1973).

The influence of biological crusts on infiltration and soil moisture is not definitive; it depends on soil type, climate, disturbance history, states of wetness of a particular soil type when it is rewetted, and types of organisms in the crust and their degree of development (Seyfried 1991, Williams 1993). The influence of biological crusts has been reported as positive (Johnson and Blackburn 1989, Johnson and Gordon 1986, Loope and Gifford 1972, Seyfried 1991), negative (Bond 1964, Brotherson et al. 1983, Graetz and Tongway 1986, Rogers 1977, Stanley 1983), or neutral (Fletcher 1960, Williams 1993). Biological crusts can be present on, and their development can be enhanced by, soil types that physically cause ponding of water on the surface, or soil types that are composed of clay and fine silt and are characterized by poor soil moisture infiltration (Eldridge and Greene 1994).

Biological crusts and vascular plants have complex interrelationships that can be either competitive, mutualistic, or neutral, depending on the growth stage of the organisms, climate, soil resources, plant–animal interactions, and resource management. Increased seedling establishment and plant species richness are attributed to an increased availability of microsites, nutrients, and water resulting from biological crust structure (Beymer and Klopatek 1992; Graetz and Tongway 1986; Kleiner and Harper 1972, 1977; Meyer 1986; Mucher et al. 1988; Eckert et al. 1986; Harper and Marble 1988; St Clair et al. 1984; Sylla 1987, in West 1990). In other instances, biological crusts have been described as inhibiting the establishment of vascular plant seedlings and reducing community structure (Dulieu et al. 1977, McIlvanie 1942, Savory and Parsons 1980). While some plants, such as needlegrass, are better adapted morphologically to establish in well-developed biological crusts (West 1990), establishment of other plants, such as less-adapted weedy exotics, is probably inhibited by intact microbiotic crusts development (Rosentreter 1994) More research is needed to further understand the interrelationship of biological crusts and seedling establishment.

Activities that disturb the soil surface—including grazing, off-road vehicle use, recreational hiking, and others—can reduce the maximum potential development of biological crusts. Continuous season-long grazing is harmful to microbiotic crusts, as shown by Jeffries and Klopatec (1987) and Brotherson et al. (1983). Likewise, short-duration grazing strategies characterized by intense physical impact to the soil surface are harmful to biological crusts, especially on rangeland characterized by wet winter and dry summer climates in the Great Basin. Early winter

grazing when soils are wet or frozen is not harmful to biological crust cover. Heavy grazing that persists into the late winter and early spring, however, becomes harmful (Marble and Harper 1989) because it limits the time available for regrowth of lichens and algae. These organisms can continue to grow from late winter through early spring because of optimal soil water conditions, but growth is disrupted if heavy livestock grazing persists. After early to late spring, soil water conditions are no longer optimal for biological crust development. The results of these studies appear applicable to salt desert shrub and adjacent dry sagebrush (for example, low sage and big sagebrush) cover types in the project area.

Biological crusts can be temporarily damaged by fire (Harper and Marble 1988, West 1990). Algal and cyanobacterial components of biological crusts can recover within 5 to 10 years after a fire event, whereas lichens and mosses might require 10 to 20 years to achieve substantial cover (Johansen and Rayburn 1989). With the invasion of flammable exotic grasses, such as cheatgrass, fire frequency has increased. Fire intervals of less than 5 years, which pose a substantial risk to biological crusts, have been documented on the exotic annual grasslands of the Snake River Plain (Whisenant 1990).

More research needs to be conducted on biological crusts to ascertain their ecological roles, particularly with regard to hydrology, nutrient cycling, energy flow, and biodiversity. Relative to other regions of the western United States, for example the Colorado Plateau, there has been a lack of research conducted within the interior Columbia River basin to ascertain the response of biological crusts to land use disturbances such as livestock grazing. Biological crusts are not inventoried by the BLM or Forest Service in a manner that determines condition and extent at multiple scales. Therefore, broad-scale trends of actual biological crusts extent and development between historical and current periods are not presented in this EIS.

Vascular Plants

Vascular plants conduct nutrients and water within a system of roots, stems, leaves, and reproductive structures. Vascular plants include ferns (and their allies), cone-bearing plants (conifers), and flowering plants. More than 8,000 vascular plant species are found within the project area. They are remarkably diverse, inhabiting the full spectrum of aquatic, riparian, and terrestrial habitats.

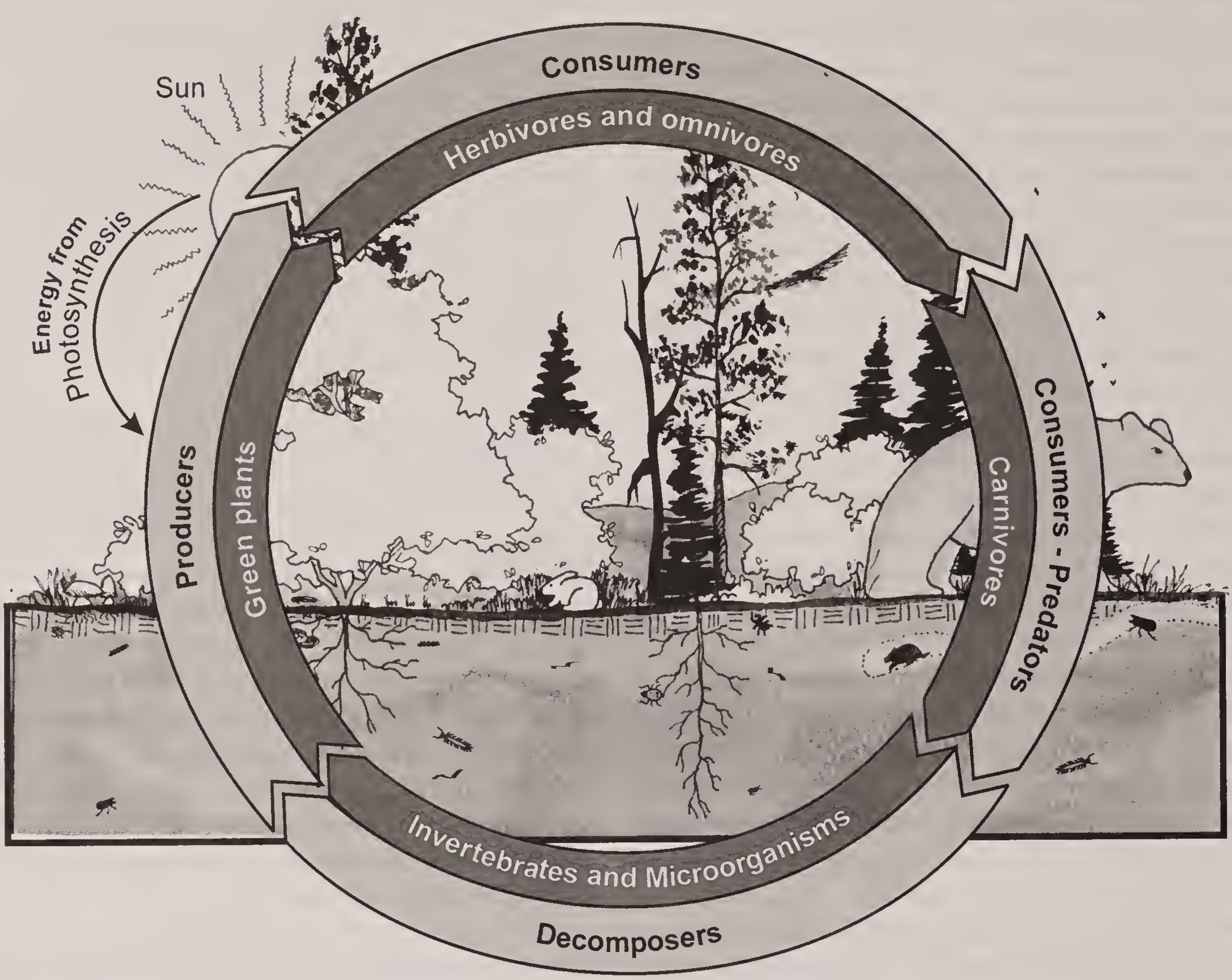
Vascular plants function as the basis of the food webs that sustain life on earth (see Figure 2-13). They protect soil from wind and water erosion by the binding action of their roots and the protection afforded by their above-ground parts. They further serve to moderate stream temperatures by providing shade to streams, enhancing habitat for aquatic- and riparian-dependent species. Vascular plants provide shelter (hiding cover and protection from the elements) for many animals. Most of the economically and culturally important plants within the project area are vascular species (for example, trees for fiber, grasses for forage).

Among the vascular plant species known to occur within the project area, nearly 700 are tracked by the Forest Service and BLM as sensitive (rare) species. Many are restricted to very narrow geographic areas. Nearly 100 species are of cultural interest to American Indian tribes. Many of the terrestrial plant communities within the basin have been, and continue to be, altered by human-caused actions. The *Scientific Assessment* found that native bunchgrass communities, low-elevation cedar/hemlock forests, and the Palouse prairie have shown significant losses in the last century. In contrast, the number of acres occupied by exotic annual plants has greatly increased during the same time period.

Many activities have adversely affected distribution and size of plant populations, reproductive capability, and interpopulation interactions of vascular plant communities within the project area; including land conversion to agriculture, livestock grazing, proliferation of exotic plant species, and changes in the historical fire regime.

Animals

Terrestrial animals are key components in all parts of the energy cycle (see Figure 2-13). They provide food, nutrients, and energy to each other and the system as a whole. Conditions and activities that change terrestrial animal populations through positive or negative modification of their habitats can affect the cycling of energy, nutrients, and other ecosystem processes essential to forest and rangeland health. Such changes can also affect socio-economic health because terrestrial animals also contribute to social and economic systems through their recreational, business, cultural, educational, and



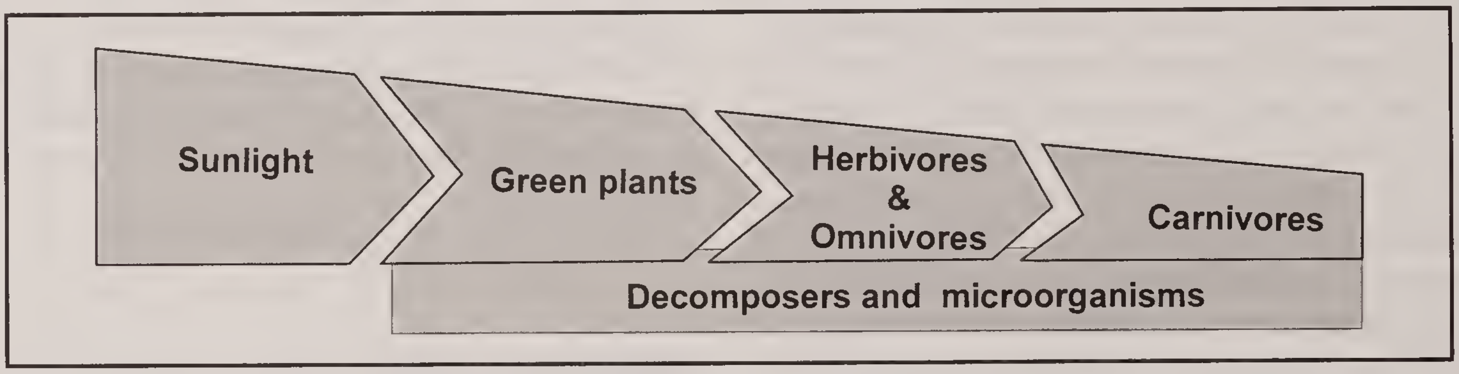


Figure 2-13. Energy Flow: Terrestrial Food Chain.

Green plants function as the basis of the food webs that sustain life on earth. They capture energy from the sun and pass the energy on to other organisms. Terrestrial animals also are key components in all parts of the energy cycle, providing food, nutrients, and energy to each other and the system as a whole. The transfer and cycling of energy and nutrients through a complex series of organisms eating other organisms is called a food web.

Conditions and activities that change terrestrial plant and animal populations through positive or negative modification of their habitats can affect the cycling of energy, nutrients, and other ecosystem processes essential to ecosystem health. Such changes can also affect socio-economic conditions, because terrestrial plants and animals also contribute to social and economic systems through their recreational, economic, cultural, medicinal, educational, spiritual, and other values.

spiritual values. Unless otherwise noted, the invertebrate and vertebrate discussion was derived from Marcot et al. (1997).

Invertebrates

Background

Some of the common groups of invertebrates include arthropods, mollusks, earthworms, protozoa, and nematodes. A diversity of habitat composition and structure is important to ensure that appropriate habitat is available for invertebrates. Appropriate soil structure and chemistry are important for soil invertebrates. Insects sometimes play an important role, in concert with drought and fire, in shaping stand and landscape structure. Invertebrates also perform vital functions in the forest by decomposing wood and litter that return nutrients to the energy cycle, and by serving as food for all other groups of animals. In addition, invertebrates turn over soil (increasing its productivity), pollinate flowers, and disperse seeds.

Invertebrates use a variety of habitat patches and microsites in forests and rangelands that may appear uniform. Important habitats for invertebrates include tree, shrub, herb and grass canopies; downed wood; snags; flowers; plant litter; and soils. Many unique and some rare or endemic species (species with very limited distribution) of invertebrates depend on talus, caves, bogs, springs, gravel, and other habitat features. Even after fires, islands of unburned trees or large trees with thick bark, shrubs, herbs, grass, and litter provide places for insects and other invertebrates to survive and recolonize.

Current Conditions and Trends

According to estimates made for the project area, only about 15 percent of invertebrate species that could potentially exist in the area have been identified. Populations of some invertebrates have declined. However, habitat requirements for invertebrates are generally at a scale so fine that it is difficult to precisely establish their current condition or status.

Factors that have caused some declines of invertebrates include: the use of pesticides; loss of litter and dead plant material; decline in forbs due to grazing, range treatments, fire exclusion, and increased fire frequency; disturbance of springs, wetlands, talus slopes, caves, and other special habitats; and conversion of grasslands and shrublands on private land to agriculture for crop production. Except for species being considered for special species status, impacts from these disturbances on invertebrates are largely unknown.

Of the known species of invertebrates, many have been accidentally or intentionally introduced via vehicles, cargo, animals, wind, and other means. Competition, displacement, and interbreeding of exotic invertebrate species pose an increasing threat to native invertebrates, plants, and other animals.

Vertebrates

Terrestrial vertebrates are important components of the project area's ecosystems. They occupy widely diverse habitats in the basin and play various ecological roles. Many of the terrestrial vertebrate species can be found in several environments, but others are restricted to one or two specific vegetative communities. For example, woodpeckers, in general, need dead trees for nesting and feeding, but for the hairy woodpecker, the species of dead tree is not as important for nest site selection as the size (it needs to be greater than 10 inches in diameter). For the pileated woodpecker, on the other hand, both the size (greater than 20 inches in diameter) and the species of the tree are important for nesting and feeding.

Animals that are most vulnerable to changes in habitat are those that (1) depend on a narrow range of habitats and (2) are not very mobile. Mobile species and animals that use a variety of habitats usually can move into other habitat types or patches when disturbance occurs. Changes in disturbance patterns and created habitats have allowed exotic animal species, such as starlings and bull frogs, to invade and compete with native species. Fragmentation has increased isolation of different terrestrial vertebrate populations and limited genetic interchange between populations.

Fire is an important element in habitat condition. Fire changes the composition and distribution of vegetation, and it improves the palatability and nutritional value of forbs, grasses, and some shrubs. Fire also increases early spring green-up, which is important to nutrition of pregnant animals. In contrast, fire suppression and change in fire regimes due to exotic plant invasions have reduced the quality of many big game habitats (Lyon et al. 1995).

Habitat for many terrestrial vertebrate species has declined greatly in the basin. Declines are due to a

number of human causes: increasing urbanization; conversion of lands to agriculture; and intensive management of forests, rangelands, and other biomes to meet human demands for food, shelter, and leisure. In the United States, declines in habitat during the past century are largely responsible for the increase in the number of species listed as threatened, endangered, proposed, or candidate species under the Endangered Species Act (Wisdom et al. in press).

Amphibians

Background

Amphibians are relatively common in dry and moist forests. Moist forests have a particularly rich diversity of amphibians due to the dampness and high presence of aquatic habitats. Cold forests and subalpine areas are generally too cold, with too short a breeding season, to provide much habitat for amphibians. In dry grasslands and dry and cool shrublands, critical seasonal and permanent wetland habitats are not common. Consequently, amphibian diversity is and probably always was predictably low in dry grasslands and dry and cool shrublands of the project area. Amphibians help to control insects; turn over soils; create burrows for other species; serve as food to fish, small birds, and mammals; and indicate water quality and quantity.

A number of amphibian species have declined or disappeared from portions of their ranges because of undetermined factors.

Current Conditions and Trends

A number of amphibian species have declined or disappeared from portions of their ranges because of undetermined factors. These include the Columbian spotted frog, northern leopard frog, and western toad.

Amphibians often use downed wood, talus, and trees, but they must be near water to reproduce. Many salamander and frog populations are vulnerable because of changes or reductions in available riparian habitats brought on by logging, grazing, road or trail construction. Mining of talus and rock for road construction, large reservoir construction, and other activities are also affecting amphibians. Introductions of exotic fish and the bullfrog can also cause a detrimental effect because they prey on native amphibians. Many constructed ponds, catchments, and spring developments on rangelands have increased amphibian habitat, but groundwater developments and water diversions into troughs and tanks have altered other habitat areas. Amphibians are also affected by changes in invertebrate populations, and by climate changes.

Reptiles

Background

Reptile distribution is influenced more by climate and terrain than by vegetation type or structure. Downed logs, talus, and rocks are important habitat features. Most reptiles are restricted to open areas and lowlands because, as cold-blooded animals, they need warmer temperatures and sunny sites such as rocky areas to regulate body temperature. Reptiles are highly susceptible to changes in climate and microsite, especially in forested ecosystems, which are at the upper elevation end of their range. On the rangelands of the project area many reptiles are also on the northernmost limits of their ranges as they are more common in the Great Basin and Mojave deserts to the south. Reptiles help to control rodents and insects (on and below the ground surface), provide food for birds and mammals, and provide burrows for other animals.

Current Conditions and Trends

In general, reptile diversity currently is high in rangelands, but species on the edge of their ranges appear to be especially susceptible to habitat degradation and climate change (Collopy and Smith 1995).

Several species of reptile, while still common, appear to have declining trends, including the common garter snake and the sharptail snake. The loss of habitat has probably adversely affected several species such as the longnose leopard lizard and the sagebrush lizard. Losses to collecting have affected the western pond turtle and Mojave black-collared lizard.

Since their habitat in the lowlands is influenced more directly by elevation, aspect, and physical features (rock, talus, terrain, and soil characteristics) than by vegetation, some of the vegetation changes due to overgrazing, exotic species invasion, and fire suppression may not have affected all reptiles as much as other species. Highways, reservoirs and other human-created structures are barriers to movement for reptiles. Changes in populations of invertebrates and small mammals also limits prey for some reptiles.

Birds

Background

Birds use all the structural stages of forestlands, shrublands, and grasslands. Many species also use dead trees and downed logs. The presence of riparian vegetation accommodates additional bird species, such as ducks and shorebirds, some of which stop only during migration (Collopy and Smith 1995). Moist forests typically have multiple layers of trees, which provide a wider variety of bird habitats than are found in dry forests. Fewer birds use cold forests than use moist forests, because climatic conditions caused by elevation lead to lower diversity in tree species, fewer insects for food, and the shorter growing season. A wide variety of birds also use grasslands and shrublands although generally fewer than forestlands.

A number of birds species in the project area have experienced long-term declines in population numbers, due to declines in a wide variety of habitats.

Current Conditions and Trends

A number of birds species in the project area have experienced long-term declines in population numbers, due to declines in a wide variety of habitats. For example, white-headed woodpeckers and flammulated owls using forested habitats, Columbian sharp-tailed grouse and sage grouse using shrubland habitats, and a number of neotropical migrant birds using grassland and riparian habitats apparently have declined in abundance.

Forest habitat for some birds has been negatively affected through reductions in extensive areas with large, shade-intolerant tree species alive and dead (western larch, western white pine and ponderosa pine) because of past forest harvesting and exotic blister rust that affected western white pine (Hann, Jones, Karl, et al. 1997). Loss of native grasslands and reduction in grassland cover have reduced plant and insect forage, nesting habitat, and hiding cover for several bird species. Improper livestock grazing and increased fire frequency due to the spread of annual exotic species (such as cheatgrass) also may damage nests of ground-nesting birds, such as short eared owl and long billed curlew, in grassland habitats. Improper livestock grazing, succession, and increases in fragmentation of habitats have favored the cowbird, a nest parasite that reduces the reproductive success of many species. Cowbirds appear to be increasing at the expense of other species, by taking advantage of habitat changes.

Declines in species such as sage grouse, Brewer's sparrows, and sage sparrows can be attributed to changes in shrubland structure, abundance, and distribution. Habitat is becoming more and more disjunct (areas have become isolated from each other), and blocks of habitat are becoming smaller islands. Changes in riparian and wetland habitat, and native grasslands, are also linked to some species declines. Loss of grass and shrub cover, and loss of structural diversity, have significantly reduced plant and insect forage, nesting habitat, and hiding cover for several species, leading to declines in sharp-tailed grouse, upland sandpipers, mountain quail, and grasshopper sparrows. However northern flicker, house wren, mountain bluebird, American robin, and gray flycatcher have increasing poplation trends, partly due to expansion in juniper woodland habitat (Collopy and Smith 1995).

Neotropical migratory birds breed and nest within the project area, but winter in south and central America. Thus, a reduction in species may be associated with changes both within and outside of the project area. The greatest impact to neotropical migratory birds appears to be the loss of riparian and wetland habitat, but native grasslands may be linked to some species' declines. Riparian vegetation is used by 64 percent of these species (Saab and Rich 1997).

Mammals

Background

Mammals use a wide variety of forestland, shrubland and grassland habitats, including burrows below the surface, litter, downed logs, rock outcrops, openings, young forests with or without shrubs, and middle, late, and old forests. As with birds, more mammal species use moist forests than use other vegetation groups. The other types of vegetation are used by similar numbers of species. The project area supports a high diversity of bats, which help control insect populations.

Current Conditions and Trends

Some species of mammals have decreased while others have increased in the project area. Those that have increased are often species which have been able to adapt to habitat changes (some ground squirrels), species which have been favored as game animals (elk

and white-tailed deer), or species which have benefitted from control of other species (some smaller predators have benefitted from control of large predators such as grizzly bears and wolves). Species that have decreased often have specific habitat requirements (stands of old, large trees), have been controlled (large predators), or are adversely affected by human activities.

As with birds, some mammals have been negatively affected by reductions in extensive areas with large, shade-intolerant tree species alive and dead (western larch, western white pine and ponderosa pine) because of past forest harvesting and exotic blister rust that affected western white pine. Many small mammals rely on the sagebrush steppe and grassland ecosystems. Several ground squirrels in the area have subspecies with very limited distributions. Loss of native plants, rodent poisoning, and soil compaction due to excessive livestock grazing pressure are affecting several species. Area of shrub steppe vegetation is declining because of conversion to crested wheatgrass, extensive planting of introduced grasses, introduction of exotic weed species, and changes in fire intensity and frequency. Increased density of juniper woodlands has reduced sagebrush and bunchgrass understory, which may reduce habitat diversity for small mammals in dry shrublands (Collopy and Smith 1995).

Bats typically roost in crevices and caves, but structures such as bridges, mines, and buildings have expanded roosting areas for bats, which may help offset human disturbance to habitat for some bat species from exploration of caves and old mine shafts. Insect control efforts reduce prey for bats. Few bat populations have been monitored, and their status is generally unknown.

Source Habitats for Terrestrial Vertebrates

Background: Refined Terrestrial Vertebrates Analysis

In the Draft EISs, the effects on terrestrial species were disclosed for 107 individual species and 15 waterbird and shorebird groups (Lehmkuhl et al. 1997). Results were disclosed for broad groupings of species (amphibians; reptiles; waterbirds and shorebirds; raptors and gamebirds; woodpeckers, nuthatches, and swifts; cuckoos, hummingbirds, and passerines; bats and small mammals; carnivores; and ungulates).

After the Draft EISs were distributed, an effort was undertaken to refine the terrestrial vertebrate analysis resulting in the identification of 12 Terrestrial Family groupings. This effort is documented in Wisdom et al. (in press) from which, unless otherwise cited, information in this section is derived.

The objectives of this additional effort were to:

1. Identify terrestrial vertebrate species whose habitats might require further assessment and management at broad spatial (geographic) scales;
2. Determine species relationships with source habitats;
3. Conduct a spatial assessment of source habitats for broad-scale species of focus;
4. Develop a system to evaluate source habitats for individual species as well as groups of species;
5. Identify species whose populations or habitats may be negatively affected by roads and associated factors; and
6. Describe broad-scale implications of managing for terrestrial vertebrates whose source habitats have undergone long-term declines in geographic extent.

This effort resulted in 173 species (see Appendix 6). This list of species was intended to be inclusive rather than exclusive and to help focus analysis on ecosystem conditions. It should not be interpreted as a list of species representing a critical legal or biological threshold.

Of the 173 species, 82 species were identified whose habitats could not be mapped reliably using the broad-scale data available for the project. These finer-scale species are primarily riparian- or wetland-dependent, and are discussed collectively in this EIS.

Ninety-one species were identified whose habitat could be mapped reliably using the broad-scale data available for the project. These 91 species were deemed broad-scale and were carried forward for more specific analysis. Of the 91 species, 64 had been analyzed by Lehmkuhl et al. (1997) and included in the Draft EISs. (See Appendix 6 for lists of species with changes in status.) Forty-three of the individual species analyzed by Lehmkuhl et al. were not carried forward to the new analysis because they were classified as fine-scale or had predicted habitat or population outcomes of 1, 2, or 3, indicating less

concern for persistence (see the Draft EISs and Lehmkuhl et al. 1997 for discussions of outcomes).

To determine habitat-species relationships for the 91 broad-scale species, "source habitats" were identified using information developed for the project area (Wisdom et al. in press, Vol. I, pages 51 to 55). Source habitats were defined as characteristics of vegetation that contribute to a species' population maintenance or growth over time and within an area. Source habitats were described using the dominant vegetation cover type and structural stage combinations that can be estimated reliably at the 247-acre (100-hectare) patch scale.

To provide for seasonal variation, seasonal habitat use was considered for the 91 species. Because some species use different source habitats during different seasons, they were counted more than once, resulting in a total of 97 ***species-seasonal combinations*** for analysis. For example, blue grouse appears twice: blue grouse-summer, and blue grouse-winter.

The 97 species-seasonal combinations then were clustered into 40 groups based on similarities in source habitats, and 37 of the 40 groups were placed within 12 "Terrestrial Families", again based on similarities in source habitats (see Appendix 6). Families were named using generalized vegetative themes as shown in Table 2-23, which shows how the 37 groups of broad-scale species of focus were placed into the 12 Terrestrial Families. In this EIS, effects are disclosed for these 12 Terrestrial Families.

The three other groups are composed of four species: black rosy finch and gray-crowned rosy finch (Group 38), Lewis' woodpecker (Group 39), and brown-headed cowbird (Group 40). The species in Groups 38 and 39 were not included in one of the Families because their habitats are restricted to small areas which were potentially under-sampled because of the finer scale pattern in which their habitats exist. The rosy finches (Group 38) use some habitats common to Rocky Mountain bighorn sheep in Family 5. The brown-headed cowbird (Group 40) was excluded from the Families because of its unique dependence on agricultural and livestock-dominated environments.

This approach focused on the management implications of changes in source habitat on groups of species and "families" of groups, rather than on individual species. The direction of change in source habitats from historical to current agrees with the direction of change identified by Lehmkuhl et al. (1997) for over 95 percent of the species that also were analyzed in the Draft EISs.

Table 2-23. Terrestrial Family Groupings.

Source Habitats Restricted to:	Source Habitats Predominated by:	Terrestrial Family Group	Terrestrial Family	Terrestrial Family Name
Forests only	Old forest stages, low elevation	1, 2, 3	1	Low Elevation Old Forest
	Old forest stages, all elevations	4 – 13	2	Broad Elevation Old Forest
	Broad range of structural stages	14 – 17	3	Forest Mosaic
	Forest stand-initiation stage (early seral)	18	4	Early Seral Montane and Lower Montane
Combination of forests and rangelands	Broad range of forest and rangeland cover types	19 – 22	5	Forest and Range Mosaic
	Forests, woodlands, and montane shrubs	23 – 25	6	Forest, Woodland, and Montane Shrubs
	Forests, woodlands, and sagebrush	26 – 28	7	Forests, Woodlands, and Sagebrush
	Unique combination of rangeland cover types and early and late seral forests	29	8	Rangeland and Early and Late Seral Forest
	Woodlands	30	9	Woodlands
Rangelands only	Broad range of grassland, shrublands, and other cover types	31, 32	10	Range Mosaic
	Sagebrush	33 – 35	11	Sagebrush
	Grassland and open canopy sagebrush	36, 37	12	Grassland and Open Canopy Sagebrush

Source: Adapted from Wisdom et al. (in press), Volume 1, Figure 5.

There has been a general downward trend in habitat for most species-seasonal combinations. Currently less than 10 percent of the basin provides habitat for 14 of the species-seasonal combinations whose source habitats have declined more than 20 percent.

In total:

- **76 species-seasonal combinations have downward trend for habitat**
  - habitats for 12 species-seasonal combinations have declined more than 50 percent
  - habitats for 43 species-seasonal combinations have declined more than 20 percent
  - habitats for 21 species-seasonal combinations have declined less than 20 percent
- **4 species-seasonal combinations have a stable trend for habitat**
- **17 species-seasonal combinations have an increasing trend for habitat**
  - habitats for 11 species-seasonal combinations have increased less than 20 percent
  - habitat for 1 species-seasonal combination has increased more than 20 percent
  - habitats for 5 species-seasonal combinations have increased more than 50 percent.

Figure 2-14 illustrates the general trends in source habitat from historical to current periods.

Species-seasonal combinations whose source habitats declined are associated with a wide variety of forested and rangeland environments. The degree to which source habitats have declined is generally consistent across the basin. Even habitats for those species-seasonal combinations that have not declined more than 20 percent in geographic extent across the basin show greater declines in some areas. The trend for species-seasonal combinations was generally similar on both federal and private lands, although generally federal lands declined to a lesser extent.

When the species-seasonal combinations are combined into groups and the groups are combined into families, similar results confirm that a wide variety of source habitats have declined in the basin. At the Terrestrial Family level, 10 of the 12 Families (all but Families 3 and 9) contain at least one group whose source habitats have declined by more than 20 percent from that historically.

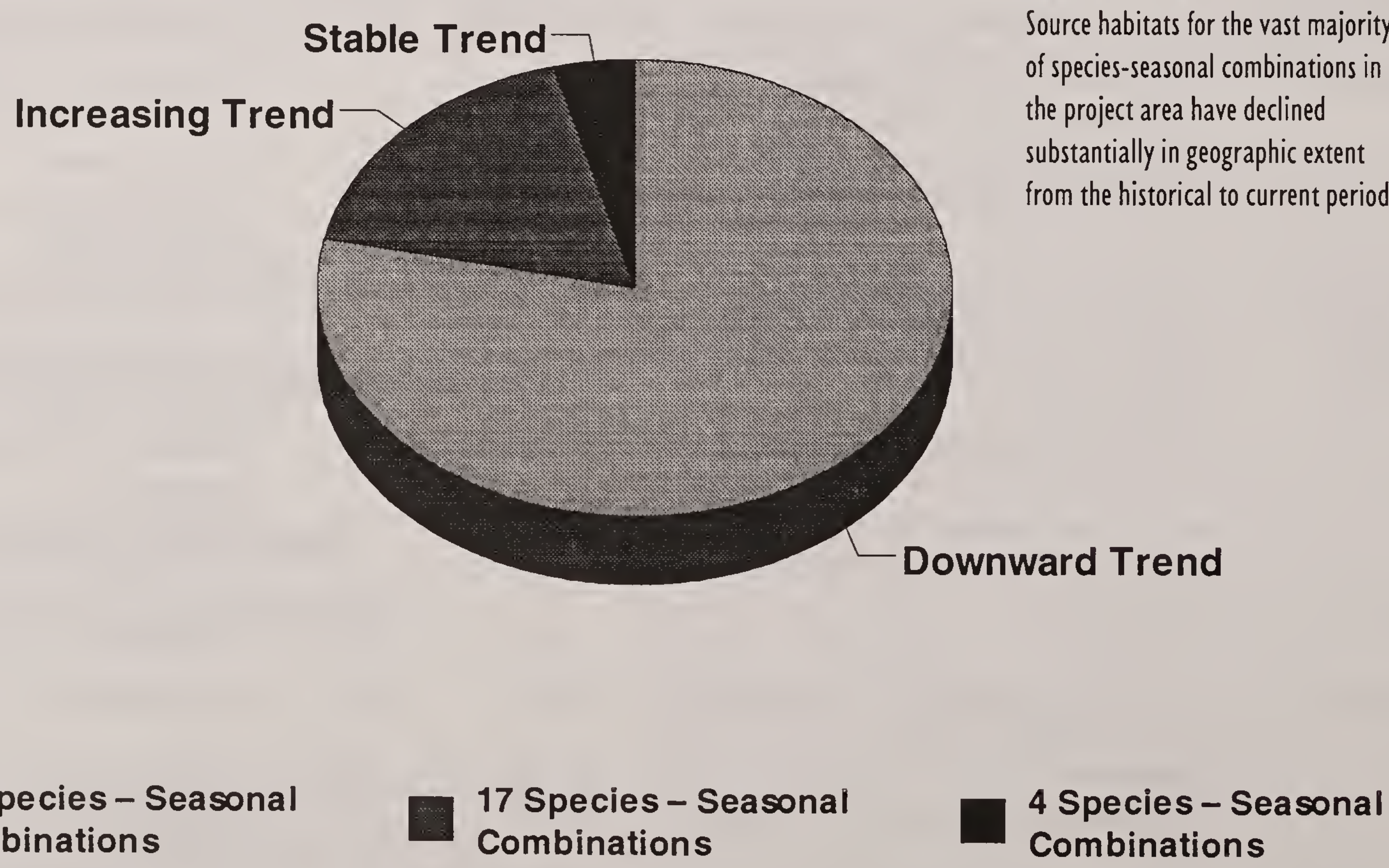


Figure 2-14. Source habitats for the vast majority of species-seasonal combinations in the project area have declined substantially in geographic extent from the historical to current period

Terrestrial Families: Current Conditions and Trends

Family clusters are a coarse-filter approach. The use of Terrestrial Families may have tenuous value when applied to a single subbasin or smaller area. However, they can be effectively applied to develop broad-scale ecosystem strategies across large geographic areas of the basin, such as single or multiple RAC/PAC areas (see Map 1-1 in Chapter 1). Effective use of the Terrestrial Families requires verifying trends exhibited by the groups included in the Family.

Following is a brief discussion of each of the 12 Terrestrial Families. Subbasins with potential for restoration of habitats for Terrestrial Families 1, 2, 4, 11, and 12 were identified by the Science Advisory Group (Map 2-11a). For a more complete discussion, including range and trend maps, see Wisdom et al. (in press).

Terrestrial Family 1 (Low Elevation, Old Forest)

Terrestrial Family 1 (old forest, low elevation source habitat) includes white-headed woodpecker, white-breasted nuthatch, pygmy nuthatch, Lewis woodpecker (migrant population), and western gray squirrel. Declines in source habitat for Terrestrial Family 1 are largely related to reductions in the old-forest lower montane community type. Declines were considered ecologically significant. For example, basin-wide there has been an 81 percent decline in geographic extent of late seral single-layered lower montane forests from historical levels. In the north-eastern portion of the basin the declines are close to 100 percent.

The primary causes for the wide-spread decline in source habitat for Family 1 are timber harvest and fire exclusion. Timber harvest has resulted in the replacement of late seral with mid seral forests. Fire exclusion has resulted in a gradual shift from shade-intolerant species, such as ponderosa pine, to shade-tolerant species, such as Douglas-fir and grand fir. Additionally, increased human occupancy and use of lands that historically supported lower montane forests have contributed to the decline.

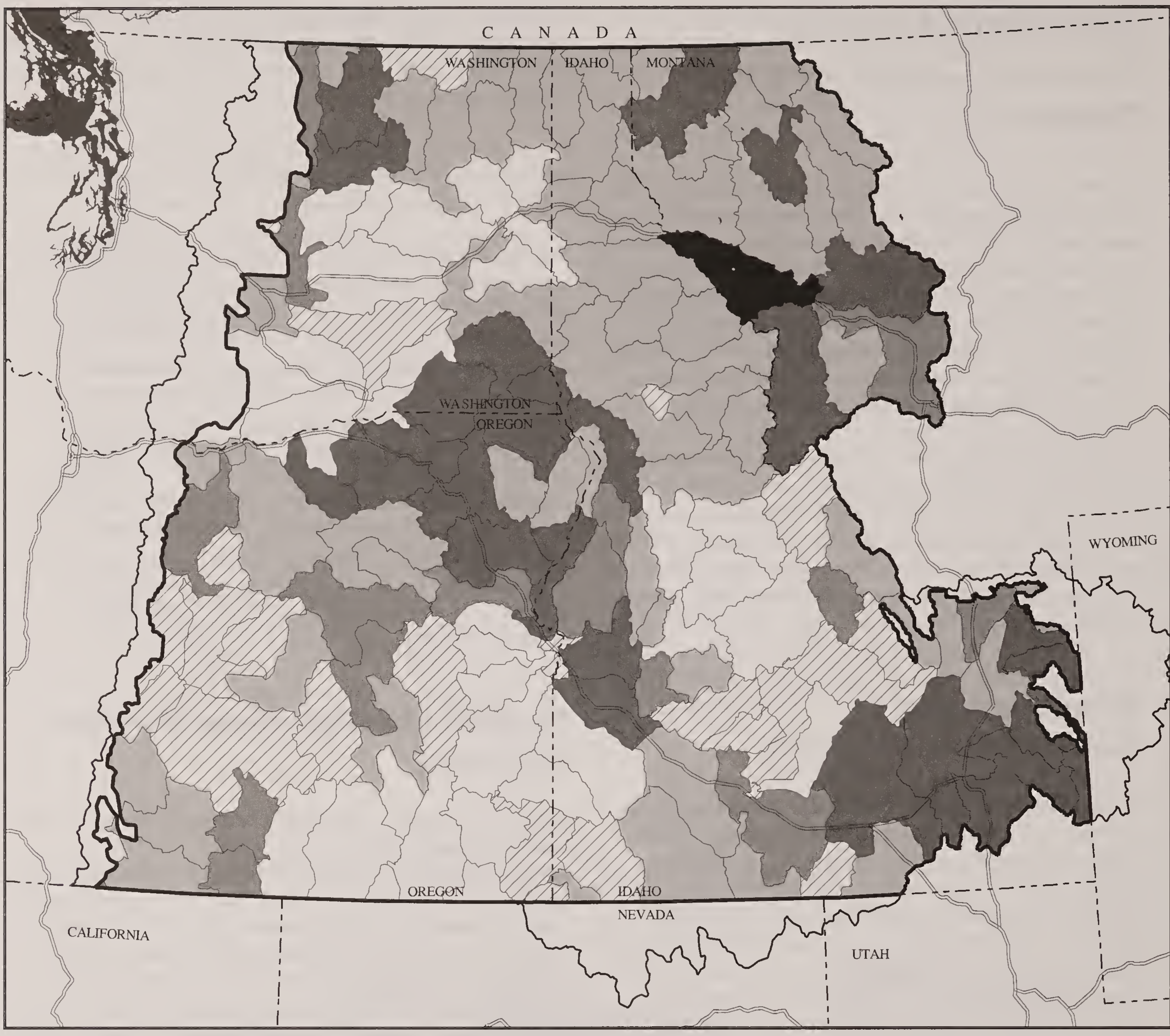
Source habitats for Family 1 also have shifted geographically across the basin. Source habitats are now found farther south in areas with a warmer average climate. Many of the increases in source habitat result from fire exclusion in what would historically have been fire-maintained savannahs with scattered large trees.

Roads also probably adversely affect Family 1, by facilitating the harvest of large diameter trees, snags and gray squirrels, the Family's only mammal.

Changes in habitat condition from historical to current were modeled (see Chapter 4 Terrestrial vertebrate section for definitions of environmental outcome and population outcome and a discussion of the models) for two species in this Family: pygmy nuthatch and Lewis' woodpecker. The predicted environmental outcomes on Forest Service- and BLM- administered lands have decreased from "A" to "D" for pygmy nuthatch and from "A" to "E" for Lewis' woodpecker (see Table 2-23a). The predicted population outcomes on all lands decreased similarly for each species. These reductions indicate substantial increased risk to the continued persistence of these species on Forest Service- and BLM- administered lands and on all lands in the Basin.

Terrestrial Family 2 (Broad Elevation, Old Forest)

Terrestrial Family 2 (old forest, broad elevation source habitat) includes blue grouse (winter), northern goshawk (summer), flammulated owl, American marten, fisher, Vaux's swift, Williamson's sapsucker, pileated woodpecker, Hammond's flycatcher, chestnut-backed chickadee, brown creeper, winter wren, golden-crowned kinglet, varied thrush, silver-haired bat, hoary bat, boreal owl, great gray owl, black-backed woodpecker, olive-sided flycatcher, three-toed woodpecker, white-winged crossbill, woodland caribou, and northern flying squirrel. Wide-spread declines in source habitat for Terrestrial Family 2 are largely related to reductions in late-seral, lower montane, single layer forest and late-seral, subalpine, multi-layer forest. Basin-wide, 59 percent of watersheds exhibit declining trends in source habitat for Family 2. Basin-wide there has been an 81 percent decline in extent of late-seral single-layered lower montane forest from historical levels, and 64 percent decline in late-seral, subalpine, multi-layer forest. Watersheds with declining trends are concentrated in the northern part of the basin and in the Snake River drainage. Not all species-seasonal combinations in Family 2 have seen declines in source habitat: trends for three-toed woodpeckers are upward, and trends for Vaux's swift, great gray owl, and woodland caribou are neutral.



Map 2-11a.
Proposed Terrestrial Family Habitat Restoration Emphasis:
Terrestrial Families 1,2,4,11,12

INTERIOR COLUMBIA BASIN ECOSYSTEM MANAGEMENT PROJECT

Supplemental Draft EIS Area
2000

Table 2-23a. Predicted Environmental Outcomes and Population Outcomes.

Species	Predicted Environmental Outcomes-FS/BLM lands		Predicted Population Outcomes-Cumulative, All lands	
	Historical	Current	Historical	Current
Family 1				
pygmy nuthatch	A	D	A	D
Lewis' woodpecker (migrant)	A	E	A	E
Family 2				
American marten	B	D	B	D
flammulated owl	B	D	B	D
northern goshawk (summer)	A	C	A	C
hoary bat	A	C	A	C
black-backed woodpecker	A	C	A	C
woodland caribou	C	D	E	E
Family 3				
blue grouse (summer)	A	B	A	B
lynx	A	A	A	C
wolverine	A	C	A	D
Family 4				
Lazuli bunting	A	C	A	D
Family 5				
gray wolf	A	C	A	D
grizzly bear	A	C	A	E
Rocky Mountain bighorn sheep (summer)	C	C	C	E
Rocky Mountain bighorn sheep (winter)	C	D	C	E
Family 6				
rufous hummingbird	A	B	A	B
northern goshawk (winter)	A	B	A	B
Family 7				
long-eared myotis	A	B	A	C
Family 8				
western bluebird	A	C	A	C
Family 9				
ash-throated flycatcher	B	B	B	B
Family 10				
pronghorn	A	C	A	C
short-eared owl	A	C	A	D
striped whipsnake	A	A	A	B
Washington ground squirrel	A	C	B	E
Family 11				
Brewer's sparrow	A	B	A	C
sage grouse (summer)	A	C	A	D
sage grouse (winter)	A	C	A	D
Family 12				
Columbian sharp-tailed grouse (summer)	B	D	B	E
grasshopper sparrow	B	D	B	E

The wide-spread decline in source habitat for Terrestrial Family 2 are primarily caused by timber harvest and fire exclusion. This has resulted in a gradual shift from shade-intolerant species (such as western larch, western white pine, and ponderosa pine) to shade-tolerant species (such as western redcedar, western hemlock, Douglas-fir and grand fir).

Source habitats for Family 2 also have shifted geographically across the basin. Similar to the situation for Terrestrial Family 1, areas showing increases in source habitat are now located to the south, and areas with decreases are farther to the north. However, the areas with increases for Family 2 are not as far south as they are for Family 1, because in the higher elevation environments associated with Family 2, successional processes respond more quickly to fire suppression.

Roads also probably adversely affect species in Family 2, by facilitating the harvest of large diameter trees and snags and the poaching of woodland caribou. Roads can also increase trapping pressure on martens and fishers.

Changes in habitat condition from historical to current were modeled (see Chapter 4 Terrestrial vertebrate section for definitions of environmental outcome and population outcome and a discussion of the models) for six species in this Family: American marten, flammulated owl, northern goshawk (summer), hoary bat, black-backed woodpecker and woodland caribou. The predicted environmental outcomes on Forest Service- and BLM- administered lands have decreased from "B" to "D" for American marten and flammulated owl; from "A" to "C" for northern goshawk (summer), hoary bat, and black-backed woodpecker; and from "C" to "D" for woodland caribou (see Table 2-23a). The predicted population outcomes on all lands decreased similarly for each species, except the woodland caribou which remained stable at "E". These reductions indicate increased risk to the continued persistence of these species on Forest Service- and BLM- administered lands and on all lands in the Basin, especially for the American marten, flammulated owl, and woodland caribou.

Terrestrial Family 3 (Forest Mosaic)

The members of Terrestrial Family 3 (forest mosaic) tend to be generalists that use a wide-range of forest conditions. They include the hermit warbler, pygmy shrew, wolverine, lynx, blue grouse (summer), and mountain quail (summer). Basin-wide, source habitat for Family 3 has not declined substantially in amount; 22 percent of watersheds exhibited declining trends in source habitat for this Family, with only the Upper Clark Fork ERU demonstrating a predominantly declining trend in source habitats. However, although the overall amount of source habitats for Family 3 have changed little since the historical period, there have been notable changes in the types of terrestrial community that make up their source habitat. For example, there is less early and late seral stages and more mid seral, lower montane forests. Because the members of this Family are generalists, such changes in type of habitat are less detrimental than they might be for more specialized species.

The primary cause of change in source habitat for Family 3 is timber harvest, which has reduced the snags and emergent large trees that would have occurred in early seral forests, thus substantially simplifying the structure of the early seral patches. Additionally, these early seral areas have more disturbed soil and are more heavily infested by noxious weeds. Another change that has occurred is the shift of upland herbland to mid seral, lower montane forest. Historically these areas were typically a savannah with scattered large trees. The change to mid seral trees is due primarily to fire exclusion and excessive livestock grazing.

Source habitats for Terrestrial Family 3 also have shifted geographically across the basin. In the northern and eastern portions of the basin, source habitats have generally decreased, while they increased in the southern and western portions of the basin.

Various human activities have probably affected Family 3. Roads facilitate the trapping of wolverine and lynx. Hydroelectric impoundments along the Columbia River and its tributaries have reduced habitat for mountain quail. Also, declines in quality of riparian shrubland, although too fine scale to be identified with broad-scale data, may have resulted in loss of habitat for mountain quail. Thinning some early seral forest types may reduce habitat for lynx.

Changes in habitat condition from historical to current were modeled (see Chapter 4 Terrestrial vertebrate section for definitions of environmental outcome and population outcome and a discussion of the models) for three species in this Family: blue grouse (summer), lynx and wolverine. The predicted environmental outcomes on Forest Service- and BLM-administered lands have remained stable at an "A" for lynx, decreased from "A" to "B" for blue grouse (summer), and decreased from "A" to "C" for wolverine (see Table 2-23a). These reductions indicate increased risk to the continued persistence of wolverine on Forest Service- and BLM- administered lands. The predicted population outcomes on all lands decreased from "A" to "C" for lynx, from "A" to "B" for blue grouse (summer), and from "A" to

"D" for wolverine. These reductions indicate increased risk to the continued persistence of lynx and wolverine on all lands in the Basin.

Terrestrial Family 4 (Early Seral Montane and Lower Montane)

Terrestrial Family 4 (early seral forest source habitat) is made up of only the lazuli bunting. This species depends on early seral, shrub-dominated conditions in forested environments. Basin-wide, 60 percent of watersheds exhibit declining trends in source habitat for this Family.

The primary causes for the change in the extent of source habitat for Family 4 are fire exclusion and the frequency and rate of timber harvest. The five-year regeneration requirement related to The National Forest Management Act may have shortened the time that stands remain in the early seral stage, by accelerating regeneration. Also, timber harvest practices have reduced the snags and emergent large trees that would have occurred in early seral forests, thus substantially simplifying the structure of the early seral patches.

Source habitats for Terrestrial Family 4 are spatially separated across the basin. In the Northern Cascades, Central Idaho Mountains, and Snake Headwaters ERUs, source habitats have generally increased, while they have decreased in other portions of the basin.

Changes in habitat condition from historical to current were modeled (see Chapter 4 Terrestrial vertebrate section for definitions of environmental outcome and population outcome and a discussion of the models) for the one species in this Family: the Lazuli bunting. The predicted environmental outcome on Forest Service- and BLM- administered lands decreased from "A" to "C" for this species (see Table 2-23a). The predicted population outcome on all lands decreased from "A" to "D." These reductions indicate increased risk to the continued persistence of Lazuli bunting on Forest Service- and BLM- administered lands and on all lands in the Basin.

Terrestrial Family 5 (Forest and Range Mosaic)

The members of Terrestrial Family 5 (forest and range mosaic) use a wide variety of forest, woodlands, and rangelands as source habitat. They include the gray wolf, grizzly bear, mountain goat, long-eared owl, California bighorn sheep, and Rocky mountain bighorn sheep (summer and winter). Basin-wide, 35 percent of watersheds exhibit declining trends in source habitat for Family 5. The greatest decline in habitat has been in the Lower Clark Fork ERU, although the Columbia Plateau, Upper Clark Fork, and Upper Snake ERUs also show decreasing trends in over half of the watersheds.

The primary causes for the change in the extent of source habitat for Family 5 are invasion of exotic plants, agriculture, and urban development. This is especially true in non-forested communities; upland herbland and upland shrubland have sharply declined because of these factors. Old forest structural stages have shifted to mid seral stages. Ecologically significant losses of western white pine, whitebark pine, western larch, and limber pine have occurred. Mountain goat and bighorn habitat has been adversely affected by fire suppression, which has allowed an increase in tree density in formerly open stands.

The pattern of source habitats for Family 5 also has shifted spatially across the basin, resulting in fragmented and more simplified patch composition and structure.

Various human activities have probably affected Family 5. Roads facilitate human access into wolf and grizzly habitat, which increases the opportunity for human-caused mortalities and displacement of wolves and grizzly bears. Mountain goats and bighorn sheep can be adversely affected by hunting (both legal and illegal), recreational hiking, timber harvest, road construction, and mining. Degradation of riparian vegetation has negatively affected foraging areas. Finally, bighorn sheep have been adversely affected by disease transmission and competition for forage from domestic sheep.

Changes in habitat condition from historical to current were modeled (see Chapter 4 Terrestrial vertebrate section for definitions of environmental outcome and population outcome and a discussion of the models) for three species in this Family: gray wolf, grizzly bear, and Rocky Mountain bighorn sheep (summer and winter). The predicted environmental outcomes on Forest Service- and BLM- administered lands have decreased from "A" to "C" for gray wolf and grizzly bear and from "C" to "D" for Rocky Mountain bighorn sheep (winter); however, it remained stable at a "C" for Rocky Mountain bighorn sheep (summer) (see Table 2-23a). The predicted population outcomes on all lands decreased from "A" to "D" for gray wolf, "A" to "E" for grizzly bear, and "C" to "E" for Rocky Mountain bighorn sheep (summer and winter). These reductions indicate substantial increased risk to the continued persistence of these species on Forest Service- and BLM- administered lands and on all lands in the Basin.

Terrestrial Family 6 (Forest, Woodland, and Montane Shrub)

The members of Terrestrial Family 6 (forest, woodland, and montane shrub) use a wide variety of forest, woodlands, and rangelands as source habitat. Species include the rufous hummingbird, broad-tailed hummingbird, sharptail snake, California mountain kingsnake, black-chinned hummingbird, and northern goshawk (winter). Basin-wide, 45 percent of watersheds exhibit declining trends in source habitat for Family 6, particularly in the Blue Mountains, Northern Glaciated Mountains, Lower Clark Fork, and Upper Clark Fork ERUs. Data indicating trends in the condition of several special habitat features important to members of this Family are not available at the broad scale.

The primary causes for the change in extent of source habitat for Family 6 are fire exclusion, heavy livestock grazing, intensive timber harvest, and road building. There have been ecologically significant declines in early seral and late seral, single layer, montane forest and in the upland shrub community, some of which transitioned to upland woodland. Fire exclusion can allow increased canopy cover which reduces understory shrubs and herbs; heavy grazing can have a similar effect. Fire exclusion and heavy grazing can also simplify habitat patterns.

The pattern of source habitats for Terrestrial Family 6 also have shifted spatially across the basin, resulting in fragmented and more simplified patch composition and structure. Amounts of source habitats also have shifted geographically across the basin. In areas in the northern and eastern portions of the basin, source habitats generally have decreased, while they have increased in the central and southern portions of the basin.

Various human activities have probably affected Family 6. For example, humans can have a direct effect on snakes in this Family through collection, harassment, and mortalities.

Changes in habitat condition from historical to current were modeled (see Chapter 4 Terrestrial vertebrate section for definitions of environmental outcome and population outcome and a discussion of the models) for two species in this Family: rufous hummingbird and northern goshawk (winter). The predicted environmental outcomes on Forest Service- and BLM-administered lands have decreased from "A" to "B" for both species (see Table 2-23a). The predicted population outcomes on all lands decreased similarly for each species. These reductions indicate only slight increased risk to the continued persistence of these species on Forest Service- and BLM- administered lands and on all lands in the Basin.

Terrestrial Family 7 (Forest, Woodland, and Sagebrush)

The members of Terrestrial Family 7 (forest, woodland, and sagebrush) use a complex pattern of a wide variety of forest, woodlands, and sagebrush cover types as source habitat. They include the Yuma myotis, long-eared myotis, fringed myotis, long-legged myotis, pine siskin, pale western big-eared bat, western small-footed myotis, spotted bat, and pallid bat. The bats in Family 7 also require special habitat features such as cliffs, caves, bark, or snags. Basin-wide, trends for Family 7 source habitats are relatively stable or increasing; 32 percent of watersheds exhibiting declining trends, particularly the Upper Snake, Columbia Plateau, and Lower Clark Fork ERUs.

Stable trends in source habitats throughout much of the basin reflects the ability of the species in Family 7 to use a wide variety of cover types and structural stages. Losses in one source habitat have generally been offset by increases in another. However, basin-wide changes in landscape patterns and simplification of patch composition and structure may have adversely affected members of this Family.

The pattern of source habitats for Terrestrial Family 7 has not shifted spatially across the basin to any great degree. In the northern and eastern portions of the basin, source habitats are decreasing somewhat.

Various human activities have likely affected Family 7. Humans can have a direct effect on bats through disturbance at roosts, loss of roosts, and mortality. Roads can indirectly contribute to this by increasing access to roosts. Loss of riparian habitat to dams and water diversions and degradation of vegetation through road construction, grazing, and recreation activities may have reduced prey and roosts for bats.

Changes in habitat condition from historical to current were modeled (see Chapter 4 Terrestrial vertebrate section for definitions of environmental outcome and population outcome and a discussion of the models) for one species in this Family: the long-eared myotis. The predicted environmental outcome on Forest Service- and BLM- administered lands has decreased from "A" to "B" for this species (see Table 2-23a). This reduction indicates only slight increased risk to the continued persistence of this species on Forest

Service- and BLM- administered lands. The predicted population outcome on all lands decreased from "A" to "C." This reduction indicates increased risk to the continued persistence of long-eared myotis on all lands in the Basin.

Terrestrial Family 8 (Rangeland and Early and Late Seral Forest)

The only member (western bluebird) of Terrestrial Family 8 (rangeland and early and late seral forest) uses early and late seral forests, woodlands, shrublands, and grasslands as source habitat. Basin-wide, 72 percent of watersheds exhibit declining trends in source habitat for Family 8. Trends in the Northern Great Basin and Owyhee Uplands ERUs are neutral, but in all other ERUs the trend is decreasing.

The primary causes for change in extent of source habitat for Family 8 are fire exclusion, heavy livestock grazing, intensive timber harvest, and road building. There have been ecologically significant declines in early seral, late seral, single layer, montane forest, upland shrublands, and upland herblands. Fire exclusion can allow increased canopy cover which reduces understory shrubs and herbs; heavy grazing can have a similar effect. Fire exclusion and heavy grazing can also simplify habitat patterns. Timber harvest and fire exclusion have resulted in a gradual shift from shade-intolerant species to shade-tolerant species. Also, timber harvest practices have reduced the snags and emergent large trees that would have occurred in early seral forests, thus substantially simplifying the structure of the early seral patches.

Changes in habitat condition from historical to current were modeled (see Chapter 4 Terrestrial vertebrate section for definitions of environmental outcome and population outcome and a discussion of the models) for the one species in this Family: the western bluebird. The predicted environmental outcome on Forest Service- and BLM- administered lands decreased from "A" to "C" for this species (see Table 2-23a). The predicted population outcome on all lands also decreased from "A" to "C". These reductions indicate increased risk to the continued persistence of western bluebird on Forest Service- and BLM- administered lands and on all lands in the Basin.

Terrestrial Family 9 (Woodland)

The two members of Terrestrial Family 9 (woodland; species include the ash-throated flycatcher and bushtit) primarily use upland woodlands and upland shrubland community groups. Basin-wide, 18 percent of watersheds exhibit declining trends in source habitat for Family 9, with only the Northern Cascades ERU showing more watersheds with decreasing trends than with increasing trends.

The increasing trends in source habitats throughout much of the basin are due to increases in the juniper-sagebrush cover type, which has more than doubled in the basin due to livestock grazing and fire suppression. However, the quality of these source habitats may be lower than it was historically because of increased density of woodlands and loss of native herbacious understories and loss of large decadent trees.

Changes in habitat condition from historical to current were modeled (see Chapter 4 Terrestrial vertebrate section for definitions of environmental outcome and population outcome and a discussion of the models) for one species in this Family: the ash-throated flycatcher. The predicted environmental outcome on Forest Service- and BLM- administered lands has remained stable at "B" for this species (see Table 2-23a). The predicted population outcome on all lands also remained stable at "B". This stability indicates little risk to the continued persistence of ash-throated flycatcher in the Basin.

Terrestrial Family 10 (Range Mosaic)

The members of Terrestrial Family 10 (range mosaic) use a variety of shrublands, woodlands, and herblands as source habitat. They include the ferruginous hawk, burrowing owl, short-eared owl, vesper sparrow, lark sparrow, western meadowlark, pronghorn antelope, mojave black-collared lizard, longnose leopard lizard, striped whipsnake, longnose snake, ground snake, Preble's shrew, white-tailed antelope squirrel, Washington ground squirrel, Wyoming ground squirrel, and Uinta ground squirrel. Basin-wide, 52 percent of watersheds exhibit declining trends in source habitat for Family 10. Watersheds with declining trends are concentrated in the northern half of the basin and the Snake River drainage. Nine ERUs show declining trends greater than 50 percent.

The upland shrubland and herbland terrestrial communities both have had ecologically significant declines. The upland shrubland decline was caused by conversion to agriculture and increases in the exotic herbland, upland herbland, and upland woodland. The upland herbland decline was caused by conversion to agriculture and increases in mid seral,

lower montane forest and upland shrubland. In general, patch habitat quality declined from historical because of conversion to agriculture, successional transitions caused by fire exclusion, and excessive livestock grazing. These have caused higher levels of canopy closure of shrubs.

The pattern of source habitats for Terrestrial Family 10 also has shifted spatially across the basin. Watersheds with neutral or increasing trends in source habitats are concentrated in the south-central portion of the basin, with all other areas having decreases.

Various human activities have probably affected Family 10. Biological crusts can be destroyed by livestock trampling and off-road vehicles. Poisoning and recreational shooting can adversely affect all four species of ground squirrels in Family 10, which in turn can adversely affect owls and other species. Fences can restrict pronghorn antelope movement.

Changes in habitat condition from historical to current were modeled (see Chapter 4 Terrestrial vertebrate section for definitions of environmental outcome and population outcome and a discussion of the models) for four species in this Family: pronghorn, short-eared owl, striped whipsnake and Washington ground squirrel. The predicted environmental outcomes on Forest Service- and BLM- administered lands have decreased from "A" to "C" for pronghorn, short-eared owl, and Washington ground squirrel, and remained stable at "A" for the striped whipsnake (see Table 2-23a). The predicted population outcomes on all lands decreased from "A" to "C" for pronghorn, from "A" to "D" for short-eared owl, from "B" to "E" for Washington ground squirrel, and from "A" to "B" for striped whipsnake. These reductions indicate increased risk to the continued persistence of pronghorn, short-eared owl, and Washington ground squirrel on Forest Service- and BLM- administered lands and on all lands in the Basin, with the risk for Washington ground squirrel being substantially increased on all lands. There has been little increased risk to the continued persistence of striped whipsnake on Forest Service- and BLM- administered lands and only a slight increased risk on all lands in the Basin.

Terrestrial Family 11 (Sagebrush)

Nearly all the members of Terrestrial Family 11 (which includes sage grouse [summer], sage grouse [winter], sage thrasher, Brewer's sparrow, sage sparrow, lark bunting, pygmy rabbit, sagebrush vole, black-throated sparrow, kit fox, and loggerhead shrike) use open and closed canopy, low-medium shrub stages of big sagebrush, low sagebrush, and mountain big sagebrush as source habitat. Other

The upland shrubland communities used by members of Family 11 have had an ecologically significant decline; this decline is the major cause of change in source habitats for this Family.

important source habitats include salt desert shrub, antelope bitterbrush–bluebunch wheatgrass, and herbaceous wetlands. Basin-wide, 42 percent of watersheds exhibit declining trends in source habitat for Family 11. For the most part, the Northern Cascades, Southern Cascades, Northern Glaciated Mountains, and Lower Clark Fork ERUs contain little habitat for members of this Family. Of the remaining ERUs, the Upper Clark Fork, Upper Snake, and Snake Headwaters ERUs show a declining trend; the others have a neutral trend.

There has been a broad-scale redistribution of habitats and a broad-scale reduction, fragmentation, and simplification of habitats for this Family. The upland shrubland communities used by members of Family 11 have had an ecologically significant decline; this decline is the major cause of change in source habitats for this Family. The upland shrubland decline was caused by conversion to agriculture and increases in the exotic herbland, upland herbland and upland woodland. In general, patch habitat quality declined from historical because of conversion to agriculture, successional transitions caused by fire exclusion, and excessive livestock grazing, causing higher levels of canopy closure by shrubs.

Various human activities have probably affected Family 11. Humans can have a direct effect on the species in this Family through disturbance at sage grouse leks (breeding sites) and winter areas, and mortalities. Biological crusts can be destroyed by livestock trampling and off-road vehicles. Poisons targeted at coyotes can adversely affect kit fox.

Changes in habitat condition from historical to current were modeled (see Chapter 4 Terrestrial vertebrate section for definitions of environmental outcome and population outcome and a discussion of the models) for two species in this Family: Brewer's sparrow and sage grouse (summer and winter). The predicted environmental outcomes on Forest Service- and BLM- administered lands have decreased from "A" to "B" for Brewer's sparrow and from "A" to "C" for sage grouse (summer and winter) (see Table 2-23a). These reductions indicate increased risk to the continued persistence of sage grouse on Forest Service- and BLM- administered lands. The predicted population outcomes on all lands decreased from "A" to "C" for

Brewer's sparrow and from "A" to "D" for sage grouse. These reductions indicate increased risk to the continued persistence of both these species on all lands in the Basin.

Terrestrial Family 12 (Grassland and Open-canopy Sagebrush)

The members of Terrestrial Family 12 (which includes Columbian sharp-tailed grouse [summer], clay-colored sparrow, grasshopper sparrow, and Idaho ground squirrel) are closely associated with upland herblands, primarily fescue–bunchgrass. Basin-wide, 60 percent of watersheds exhibit declining trends in source habitat for Family 12, occurring across most ERUs.

There has been a broad-scale redistribution of habitats and a broad-scale reduction, fragmentation, and simplification of habitats for this Family. Upland shrubland and herbland terrestrial communities both show ecologically significant declines. The upland shrubland decline was caused by conversion to agriculture and increases in the exotic herbland, upland herbland, and upland woodland. The upland herbland decline was caused by conversion to agriculture and increases in mid seral, lower montane forest, and upland shrubland. In general, patch habitat quality declined from historical because of conversion to agriculture, successional transitions caused by fire exclusion, and excessive livestock grazing, which have caused higher levels of canopy closure of shrubs. Bunchgrasses (critical habitat components for Family 12) were substantially affected by high intensity grazing in the late 1800s and early 1900s. Increasing forest encroachment adversely affects the Idaho ground squirrel.

Various human activities have probably affected Family 12, through habitat loss due to agriculture, residential development, and increased recreational activities. Biological crusts can be destroyed by livestock trampling and off-road vehicles. Recreational shooting adversely affects Idaho ground squirrels.

Changes in habitat condition from historical to current were modeled (see Chapter 4 Terrestrial vertebrate section for definitions of environmental outcome and population outcome and a discussion of the models) for two species in this Family: Columbian sharp-tailed grouse and grasshopper sparrow. The predicted environmental outcomes on Forest Service- and BLM-administered lands have decreased from "B" to "D" for both species (see Table 2-23a). These reductions indicate increased risk to the continued persistence of Columbian sharp-tailed grouse and grasshopper sparrow on Forest Service- and BLM- administered lands. The predicted population outcomes on all lands decreased from "B" to "E" for both species. These reductions indicate substantial increased risk to the continued persistence for both these species on all lands in the Basin.

Substantially Declining Source Habitats

Wisdom et al. (in press) identified 155 cover type structural stage combinations that constituted terrestrial source habitats. Further analysis by the EIS team indcated that 53 of these have declined in geographic extent by at least 20 percent from the historical to the current period for the project as a whole. In addition, not only was the decline for these 53 apparent for the project area as a whole, but declines outnumbered increases at a more local (ERU) level, showing that the decline was generally present throughout most areas within the project area (see Appendix 5). These 53 cover type-structural stage combinations represent source habitats that have declined substantially in geographic extent from historical to current periods and will be referred to as such in many places in Chapters 2 through 4 in this EIS.

All the species in the 12 Terrestrial Families use some of these 53 cover type–structural stages as source habitats. However, most of these substantially declining source habitats (41 out of 53) are especially important to the species in five of the Terrestrial Families (Families 1, 2, 4, 11, and 12). The remaining 12 source habitats are habitat only for species in one of the other 7 Terrestrial Families.

The 5 Terrestrial Families represent a subset of the 12 Terrestrial Families with source habitats that declined to the greatest extent between historical and current periods. They best represent the "habitats at risk" Families. It is probable that declines in populations of species in these five Terrestrial Families are generally attributable to substantial declines in the geographic extent of some source habitats.

Roads and Wide-ranging Carnivores

Roads can pose a direct threat to population fitness for a number of wide-ranging terrestrial carnivores by facilitating over-trapping or other fatal interactions with humans. For the gray wolf and grizzly bear, researchers have verified a strong negative relationship between road density and population fitness.

Roads hypothetically pose a direct threat to population fitness for a number of wide-ranging terrestrial carnivores by facilitating over-trapping or other fatal interactions with humans.

Similar relationships have been hypothesized for wolverine and lynx.

Because of the observed or suspected effects on population fitness, the current abundance of source habitats in relation to road density was mapped for gray wolves, grizzly bears, wolverine, and lynx. The mapping was intended to identify large areas with abundant source habitats and low road densities, which presumably would have the highest potential to support persistent populations. This mapping effort identified seven areas: the Greater Yellowstone area, the Northern Continental Divide area, the North Cascades area, the Bitterroot–Central Idaho area, the Eagle Cap Wilderness–Hells Canyon area, the Owyhee area, and the Crater Lake area (Map 2-11b). All of these areas are within or adjacent to wilderness areas or national parks, most occur at high elevations, and most are currently occupied by all or most of the four carnivore species. Four of these areas are partially outside of the ICBEMP project area. Only a small portion (less than 5 percent) of the Bitterroot–Central Idaho area (Area 4) is outside the project area. In contrast, less than 10 percent of the Greater Yellowstone Area (Area 1) and North Cascades area (Area 3) are contained within the project area, and only about 50 percent of the Crater Lake area (Area 7) is within the project area.

All seven areas contain places with zero to low road density and moderate to high abundance of source habitat for *grizzly bears.* Four of the seven areas are either currently occupied by grizzly bears or are within areas that have had occasional sightings or potential occurrences since 1970. These are: the Greater Yellowstone area, Northern Continental Divide area, North Cascades area, and Bitterroot–Central Idaho area. (Two other areas currently occupied by grizzly bears, the Selkirk and Cabinet–Yaak areas, contain no subbasins with both moderate to high abundance of source habitats and zero to low road density and therefore are not included in the seven areas.)

Five of the seven areas contain places with zero to low road density and moderate to high abundance of source habitat for *wolves.* These are: the Greater Yellowstone area; Northern Continental Divide area; Bitterroot–Central Idaho area; Eagle Cap Wilderness–Hells Canyon area; and Owyhee area. However, only three of the seven areas are currently occupied by wolves: Greater Yellowstone area; Northern Continental Divide area; and Bitterroot–Central Idaho area. Wolves have recently been released in the Greater Yellowstone area and Bitterroot–Central Idaho area, resulting in rapid population growth in these areas.

Six of the seven areas contain places with zero to low road density and moderate to high abundance of source habitat for *wolverines.* These are: the Greater Yellowstone area; Northern Continental Divide area; North Cascades area; Bitterroot–Central Idaho area; Eagle Cap Wilderness–Hells Canyon area; and Carter Lake area. All six of these areas have had verified occurrences of wolverine since 1961. The largest concentration of occurrences appears to be within the Bitterroot–Central Idaho area.

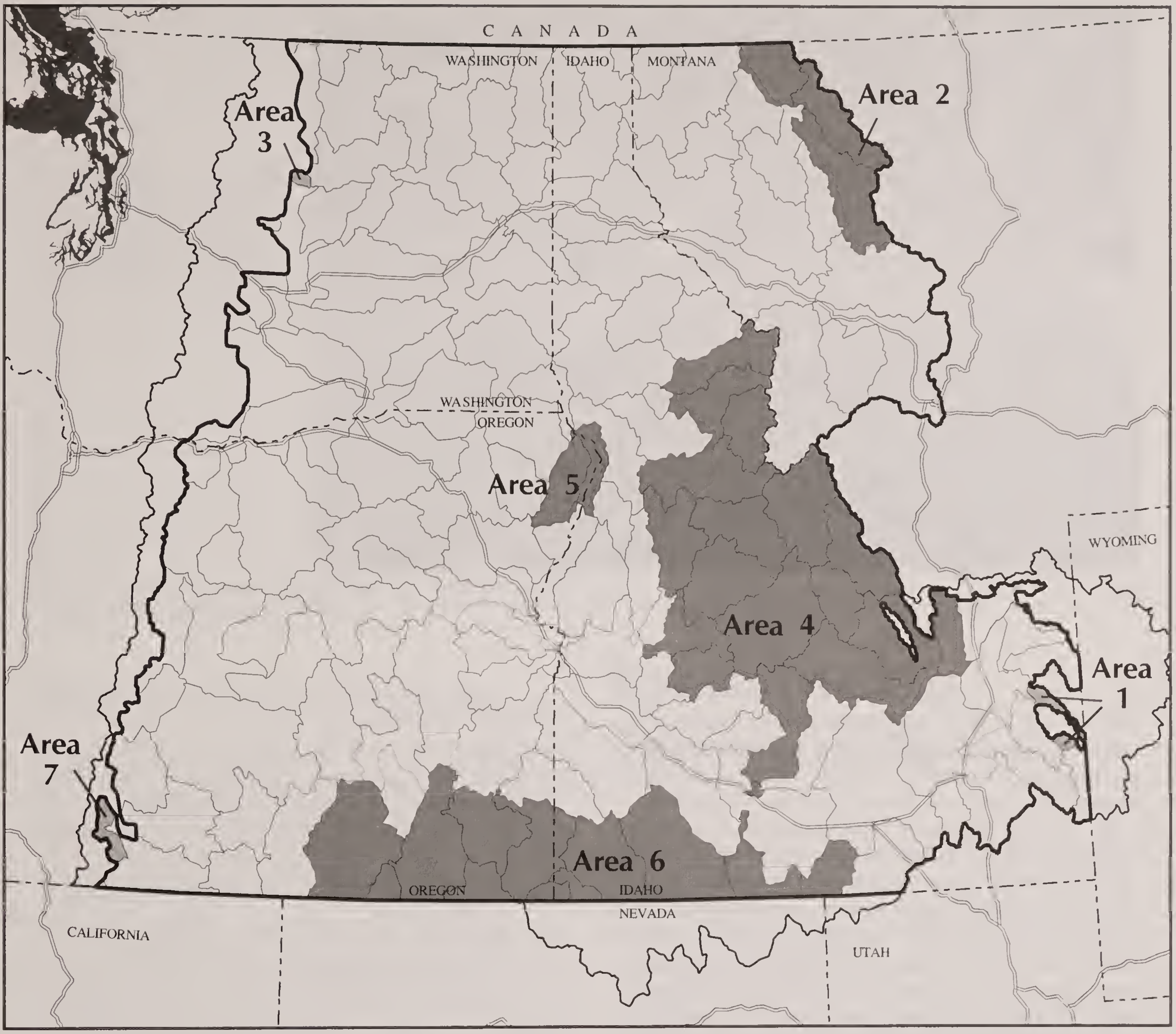
Six of the seven areas contain places with zero to low road density and moderate to high abundance of source habitat for *lynx.* These are: the Greater Yellowstone area; Northern Continental Divide area; North Cascades area; Bitterroot–Central Idaho area; Eagle Cap Wilderness–Hells Canyon area; and Carter Lake area. Of these six, the Carter Lake area may be outside the geographic range of lynx. In contrast to wolverine, the majority of verified lynx locations corresponded to subbasins with a high abundance of lynx source habitats, regardless of road density.

Two important points can be derived from this information. First: large areas of the basin composed of moderate or high abundance of source habitats may not be used, or may be under-used, by wide-ranging carnivores because of negative interactions with humans, which are facilitated by roads. Second: areas with moderate or high abundance of source habitats and low road densities could serve as 'building blocks' from which an overall network of habitats for wide-ranging carnivores could be devised.

Riparian–Wetland Species

NOTE: See the Aquatic/Riparian/Hydrologic section for additional discussion of riparian and wetland vegetation types.

Riparian areas contain the most biologically diverse habitats on federal lands, because of their variety of structural features including live and dead vegetation, and because of the close proximity of riparian areas to water bodies. Riparian areas are valuable to terrestrial vertebrates for food, cover, and water (Bull 1977; Thomas et al. 1979). They provide important habitat



**Map 2-11b.
Carnivore Habitat
with Low Road Density**

INTERIOR COLUMBIA
BASIN ECOSYSTEM
MANAGEMENT PROJECT

Supplemental Draft EIS Area
2000

No overlap of moderate to high carnivore habitat abundance with zero to low road density

Overlap of moderate to high carnivore habitat abundance with zero to low road density

Subbasin Borders

Major Roads

Supplemental Draft EIS Area Border

Area 1 - *Greater Yellowstone Area*
Area 2 - *Northern Continental Divide Area*
Area 3 - *North Cascades Area*
Area 4 - *Bitterroot-Central Idaho Area*
Area 5 - *Eagle Cap Wilderness-Hells Canyon Area*
Area 6 - *Owyhee Area*
Area 7 - *Crater Lake Area*

Riparian areas serve as migration routes for elk and other big game between summer and winter ranges. These areas are also valuable for other terrestrial vertebrates for food, cover, and water.

Photo by USFS.

for over half of the terrestrial vertebrate species in the project area; in some locations an even higher percentage applies. For example, of the 378 terrestrial species known to occur in the Blue Mountains, 75 percent either directly depend on riparian areas or use them more than other habitats (Thomas et al. 1979). Riparian areas provide nesting and brooding habitat for birds. They also provide thermal cover and favorable microclimates for many terrestrial vertebrate species because of increased humidity, a higher transpiration rate, shade, and increased air movement helping in homeostasis (a condition where energy expenditure is minimized), especially when surrounded by non-forested ecosystems (Thomas et al. 1979).

Riparian areas contain the most biologically diverse habitats on federal lands.

Common deciduous trees and shrubs in riparian areas—such as cottonwood, alder, willow, and red osier dogwood—are important food sources for mammals such as deer, elk, moose, hares, rabbits, voles, and beavers, as well as other animals. Riparian areas that consist of aspen and cottonwood, incorporating herbaceous and shrubby components, are very important for numerous species of amphibians, reptiles, birds, and mammals. Riparian areas also serve as big game migration routes between summer and winter range; provide travel corridors or connectors between habitat types for many terrestrial species such as carnivores, birds, and bats; and play an important role within landscapes as corridors for dispersal of plants (Bull 1977; Gregory et al. 1991; Heinemeyer and Jones 1994; Thomas et al. 1979; Vogel and Reese 1995; Washington Department of Fish and Wildlife 1995).

Riparian habitat is used by numerous terrestrial species. The combinations of various structural stages, contrast and water provides a wide array of habitats. For example large numbers of neotropical migrant bird species (species that breed in North America and winter in Central or South America) use riparian habitat either exclusively or in combination with only one other habitat type. Within the project area, 84 of the 132 breeding migrant birds (64 percent) use riparian vegetation for nesting or foraging (Saab and Rich 1977).

Wetlands also provide important habitat for a variety of species, including resident and migratory birds (for example, swallows, flycatchers, waterfowl, and shorebirds); mammals (for example, bats, ungulates, and beavers); unique plant species (for example, cattails, sedges, rushes, pond lilies, and willows); amphibians (for example, salamanders and frogs); and invertebrates (for example, caddisflies, mayflies, and dragonflies). Seasonal wetlands are often shallow and fill up quickly in early spring with the onset of groundwater recharge or thawing conditions. These areas provide critical habitat for birds

because conditions are favorable for production of invertebrates, an important food supply for migratory birds. Permanent wetlands are usually deeper water bodies that provide habitat and food for animals throughout the spring and summer.

Riparian and wetland habitats are too fine a scale to be identified with the broad-scale vegetation data used by this project (see Appendix 6 for list of fine scale species of concern). Therefore, only general broad-scale issues have been identified for riparian and wetland habitats. These broad-scale issues are: some riparian or wetland areas have declined in extent due to conversion to agriculture and other uses; other riparian or wetland areas have been degraded from activities such as grazing and recreation; the introduction of exotic plant and animal species has adversely affected riparian and wetland habitats; and dams and their operation have negatively affected riparian habitat. Many riparian shrub habitats have declined because of overgrazing (resulting in increases in native and exotic grasses) or fire exclusion (resulting in increases in conifers).

Special Habitat Features

Special habitat features are those non-vegetative factors or finer-scale characteristics of vegetation that also contribute to stationary or positive population growth. Special habitat features identified by species experts include: caves, cliffs, talus, and burrows, which are non-vegetative factors; and snags, downed logs, large hollow trees, shrub or herb understories, shrub/herbaceous, wetland/riparian, mountain shrubs, deciduous tree riparian, and vegetation contrast (Table 2, Vol. 3, Wisdom et al., in press). Thirty-one of the 40 groups and 11 of the 12 Terrestrial Families contain at least one species that uses a special habitat feature. Only Terrestrial Family 4, which contains only the Lazuli bunting, does not contain at least one species that uses these features (Wisdom et al. in press).

It is not possible to quantify the extent of the special habitat features at the broad scale because the features are too fine scale to be identified. However, most species that use them can be adversely affected by human activities. For example, rock climbing on cliffs or cutting snags for fuelwood can adversely affect dependent species.

Snags and Downed Wood

Snag-dependent species tend to increase along with the number of snags until other factors become limiting. Snag diameter and height and downed log quantity and size are important criteria for selection by dependent species (Thomas et al. 1979, Torgersen and Bull 1995). Most of the snag-dependent birds and small mammals are insectivorous and may play a role in regulating insect populations. Downed wood is important to a wide variety of terrestrial species.

Basin-wide there have been changes in the number of snags and amount of downed logs (see Table 2-23b). Generally there are fewer snags than historically where timber management or salvage of dead trees (wildfire or insect killed) has occurred. In areas where management has not occurred, there are often more snags than historically because of fire suppression actions. Roads in riparian areas have led to lower snag and downed wood levels in portions of riparian areas because of removal of dead trees for fuelwood or by timber harvesting. The diversity of habitat created by a fire pattern mosaic is rarely present in managed stands.

Special Status Terrestrial Species

Special status species include federally listed threatened or endangered species, federal proposed and candidate species, species managed as sensitive species by the Forest Service and/or BLM, and rare or narrow endemic species.

Not all federal candidate species or agency sensitive species are necessarily in decline; some species are little-known or naturally rare because of habitat rarity. It is suspected that no vertebrate species have become extirpated (local extinction) from the project area in recent decades. Although it is possible that undescribed, locally endemic species or subspecies might have vanished before they could be studied, information on other taxa is lacking (Marcot et al. 1997).

Table 2-22 (earlier in this section) provides the number of species of terrestrial organisms evaluated for the project; the number of federally listed threatened, endangered, candidate and proposed species; and BLM- or Forest Service-designated sensitive species (Marcot et al. 1997). Table 2-24 lists threatened, candidate, and proposed species; Appendix 6 lists the sensitive species.

Table 2-23b. Predicted Number of Snags And Pieces of Downed Wood Per Acre.[1]

Potential Vegetation Group	Historical	Current
	Number of large snags per acres	
Cold Forest	4.03	4.23
Dry Forest	1.92	1.56
Moist Forest	4.33	3.89
Riparian Woodland	3.13	1.82
Woodland	0.00	0.40
	Downed wood pieces per acre	
Cold Forest	9.19	9.14
Dry Forest	2.23	2.41
Moist Forest	2.10	8.00
Riparian Woodland	2.16	1.45
Woodland	0.00	0.40

[1] The predicted number of snags per acre and pieces of downed wood per acre, by Potential Vegetation Group, on Forest Service- and BLM- administered lands within the Interior Columbia River Basin project area, for the historical and current time periods.

Threatened, Endangered, Proposed, or Candidate Species

Under the Endangered Species Act of 1973, an *endangered* species is any species in danger of extinction throughout all or a significant portion of its range. A *threatened* species is any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. *Proposed* species have been proposed to the U.S. Fish and Wildlife Service or the National Marine Fisheries Service for listing as threatened or endangered. *Candidate* species are those that may be proposed for listing in the future. Table 2-24 shows the federally listed, proposed, and candidate plant, animal, and fish species in the project area (current as of November 1999). Both terrestrial and aquatic species were included here so that all species would be in one table.

All of the threatened or endangered terrestrial vertebrates have recovery plans or strategies approved by the U.S. Fish and Wildlife Service. There is an EIS for reintroduction of gray wolves, which provided the basis for wolves being reintroduced in Idaho in 1995 and 1996. See Appendix 6 for the listed species in the project area and the status of their recovery plans and critical habitat.

Populations of both peregrine falcons and bald eagles are static or increasing slightly in the project area. Peregrine falcons were delisted in September 1999. Bald eagles were reclassified from endangered to threatened in 1995; and the U.S. Fish and Wildlife Service has recently proposed that the bald eagle be delisted. The primary reason for recovery is restriction of pesticides that caused eggshell thinning and reproductive failures, but habitat improvement and road and human access management also contributed to their increase.

Gray wolves are known to occur in Idaho and in Montana. Wolves are listed as endangered in the project area in northern Montana, northern Idaho, Oregon, and Washington. Experimental populations of wolves exist in central and southern Idaho and southwestern Montana. These reintroduced populations of wolves in Yellowstone and Central Idaho appear to be expanding rapidly, with estimates of more than 10 packs in both areas in 1999. The population in north central Montana also appears to be stable or slowly expanding. Depredation on livestock continues to be a source of concern as populations expand. Management actions related to confirmed livestock depredation are the major source of human-related mortality. At the current rate of growth, it is estimated that wolves in the northern Rocky Mountains should be recovered and possibly considered for delisting by late 2002 (E. Bangs, USFWS, personal communication).

Table 2-24. Terrestrial and Aquatic Threatened, Endangered, Proposed, and Candidate Species.

Common Name	Scientific Name	FWS Status
Animals		
Woodland caribou	*Rangifer tarandus caribou*	E
Whooping crane	*Grus americana*	E, XN
Gray wolf	*Canis lupus*	E, XN
Bald eagle	*Haliaeetus leucocephalus*	T
Grizzly bear	*Ursus arctos*	T
Lynx	*Lynx canadensis*	PT
Northern Idaho ground squirrel	*Spermophilus brunneus*	PT
Washington ground squirrel	*Spermophilus washingtoni*	C
Columbia spotted frog	*Rana luteiventris*	C
Oregon spotted frog	*Rana pretiosa*	C
Invertebrates		
Utah valvata snail	*Valvata utahensis*	E
Snake River physa snail	*Physa natricina*	E
Idaho springsnail	*Fontelicella idahoensis*	E
Banbury springs limpet	*Lanx spp.*	E
Bruneau hot springsnail	*Pyrgulopsis bruneauensis*	E
Bliss Rapids snail	*Taylorconcha serpenticola*	T
Plants		
Applegate's milkvetch	*Astragalus applegatei*	E
Malheur wirelettuce	*Stephanomeria malheurensis*	E
Wenatchee Mountains (Oregon) checkermallow	*Sidalcea oregana var. calva*	E
Water howellia	*Howellia aquatalis*	T
MacFarlane's four-o'clock	*Mirabilis macfarlanei*	T
Ute's lady tresses	*Spiranthes diluvialis*	T
Howell's spectacular thelypody	*Thelypodium howellii spp. spectabilis*	T
Spalding's catchfly	*Silene spaldingii*	PE
Christ's Indian paintbrush	*Castilleja christii*	C
Basalt fleabane (daisy)	*Erigeron basalticus*	C
Slick spot peppergrass	*Lepidium papillifernm*	C
Northern wormwood	*Artemisia campestris* var. *wormskioldii*	C
Umtanum desert-buckwheat	*Eriogonum codium*	C
Showy stickseed	*Hackelia venusta*	C
White Bluffs bladderpod	*Lesquerella tuplashensis*	C
Fish		
White sturgeon (Kootenai River)	*Acipenser transmontanus*	E
Sockeye salmon (Snake River)	*Oncorhynchus nerka*	E
Chinook salmon (Upper Columbia River)	*Oncorhynchus tshawytscha*	E
Steelhead (Upper Columbia River)	*Oncorhynchus mykiss mykiss*	E
Borax Lake chub	*Gila boraxobius*	E
Lost River sucker	*Deltistes luxatus*	E
Shortnose sucker	*Chasmistes brevirostris*	E
Steelhead (Snake River)	*Oncorhynchus mykiss mykiss*	T
Steelhead (Mid Columbia)	*Oncorhynchus mykiss mykiss*	T
Fall chinook salmon (Snake River)	*Oncorhynchus tshawytscha*	T
Spring/summer chinook salmon (Snake River)	*Oncorhynchus tshawytscha*	T
Bull trout	*Salvelinus confluentus*	T
Hutton tui chub	*Gila bicolor spp.*	T
Foskett speckled dace	*Rhinichthys osculus spp.*	T
Warner sucker	*Catostomus warnerensis*	T
Lahontan cutthroat trout	*Oncorhynchus clarki henshawi*	T

Key:
C = Federally candidate species
E = Federally listed as endangered
PE = Federally proposed as endangered
T = Federally listed as threatened
PT = Federally proposed as threatened
XN = Experimental, non-essential

Source: U.S. Fish and Wildlife Service (July 15, 1999), Federal Register 18/28/99 and 10/25/99

Grizzly bears are known to occur in northern and eastern Idaho and in Montana. Grizzly bear populations appear to be increasing in the Yellowstone and the Northern Continental Divide recovery areas and are near recovery goals, although human-caused mortalities of females continue to be a concern. The Selkirk, Cabinet–Yaak, and Northern Cascades recovery areas appear to have small populations and are not yet approaching recovery goals. Recent research on collared bears has shown movement between the Selkirk and Cabinet–Yaak ecosystems within 20 miles of the U.S.–Canada border. The U.S. Fish and Wildlife Service has concluded that the two areas should now be considered as one ecosystem for grizzly bear recovery purposes. There have been no recent, confirmed reports of grizzly bears in the Bitterroot recovery area. Currently the U. S. Fish and Wildlife Service is preparing an EIS related to reintroduction of grizzly bears in the Bitterroot recovery area.

Woodland caribou are currently restricted to the Selkirk Mountains in northeastern Washington and northern Idaho. The population was augmented from 1987 to 1990 and is now estimated to number from 60 to 65 individuals. It is believed that predation by mountain lions is currently limiting the population, with human-caused mortality and direct disturbance as contributing factors.

Whooping cranes in Idaho are designated as an experimental population as part of the effort to establish additional populations. In Montana, whooping cranes are still listed as endangered. Sighting records indicate that whooping cranes do not currently occupy the western portion of Montana included in the project area.

Plant species that are federally listed as threatened or endangered and that occur in the project area include: Water howellia (threatened), Applegate's milk-vetch (endangered), MacFarlane's four-o'clock (threatened), Ute's lady-tresses (threatened), Howell's spectacular thelypody (threatened), Malheur wire-lettuce (threatened), and Wenatchee Mountains checkermallow, Applegate's milk-vetch, Howell's spectacular thelypody, and Malheur wire-lettuce occur only in Oregon; water howellia and Ute's lady-tresses occur throughout the project area; MacFarlane's four-o'clock occurs in Idaho and Oregon; and the Wenatchee Mountains Checkermallow occurs in Washington. Of the listed plant species only Applegate's milkvetch, Malheur wirelettuce, and MacFarlane's four-o'clock have approved recovery plans.

In 1998, the U.S. Fish and Wildlife Service proposed to list the lynx as threatened. Lynx are uncommon, but widely distributed, in the project area. A decision on listing is anticipated in January 2000. The northern Idaho ground squirrel, limited to localized mountain meadows in west central Idaho, has also been proposed for listing as threatened. The Spalding's catchfly, found in localized populations throughout the Palouse region in northeast Oregon and southeast Washington has been proposed for listing as threatened.

Candidate species in the project area are the Columbia spotted frog (eastern Oregon and Washington and southwestern Idaho), Oregon spotted frog (limited areas in the eastern Cascades), Washington ground squirrel (north central Oregon and south central Washington), Christ's paintbrush (south central Idaho), basalt daisy (south central Washington), slick spot peppergrass (south western Idaho), northern wormwood (north central Oregon and south central Washington), Umtanum desert-buckwheat (south central Washington), showy stickseed (central Washington), and White Bluffs bladderpod (south central Washington).

Agency Sensitive Species

The Forest Service and the BLM also maintain regional and state lists of *sensitive* species for which there are significant current or predicted downward trends in population numbers, density, or habitat capability; or species with limited distribution.

Currently 23 invertebrates, 14 amphibians or reptiles, 66 birds, 19 mammals, and more than 700 plant species are listed as sensitive by the Forest Service and/or the BLM in the project area. See Appendix 6 for a list of these species. Many invertebrates listed as sensitive are not included in the appendix since habitat for such species is managed at a finer scale than this EIS.

Endemic Species

Endemic species are those that occur naturally in a certain region and whose distribution is relatively limited to a particular area. A number of endemic species exist in the project area. These species are often either locally or regionally endemic, are disjunct from other populations of the same species, or occur at the periphery of their range. Centers of

concentration of species rarity and endemism and high biodiversity were identified in Marcot et al. (1997). These centers of concentration seemed to pertain to taxonomic groups with low mobility. Disturbance regimes probably play a role in maintaining biodiversity of some centers of concentration (Marcot et al. 1997). Endemic species are best evaluated at finer scales, although effects on a few can be determined at the broad scale. Where this occurs, they are included in this EIS as species of broad-scale concern.

Rare plant communities were identified in the basin (Marcot et al. 1997). Some plant communities are rare because they depend on a unique set of abiotic features or because of land-altering human activities. Increases in human influence have caused some plant communities to decline further. Typically, rare plant communities occupy small areas which are better suited to finer-scale analysis.

Hunting, Viewing, and Collecting Considerations

Forests and rangelands are used by many big game species that are socially and economically important for hunting and viewing. Many are used for food and other cultural and spiritual values by local American Indian tribes and are often addressed in treaties. Historical accounts are not conclusive, but it appears that elk, mule deer, and white-tailed deer populations in forests are higher than they were before European settlement. Mule deer and white-tailed deer numbers peaked between 1940 and 1960 and possibly exceeded the capacity of their winter range. Numbers have fallen since these highs, and mule deer numbers have stabilized in recent years while white-tail numbers are slowly rising. Basin-wide white-tailed deer populations are considerably smaller than mule deer populations. The loss to human development of winter range for mule deer and overall habitat for white-tailed deer is the main limiting factor for these species. Elk have expanded their ranges in recent times, providing increased hunting opportunities but also causing potential damage in the rural and agricultural interface on private lands. In some forest settings, elk and deer are using dense stands of shade-tolerant understory trees for cover, which they would not have used as extensively under natural fire regimes.

Many of the current high populations of some big game species can be partially attributed to access management programs that control the use of roads by hunters and selective animal harvest strategies. Access management strategies among agencies to reduce vulnerability to mortality associated with roads is common for elk management. Increases in the density and use of roads across the project area provide a major factor in human-caused mortality in all big game species (Lyon et al. 1995, Marcot et al. 1997).

Bighorn sheep, mountain goats, and moose are also popular for hunting and viewing. While some bighorn populations are maintaining current numbers, other populations are generally declining because of widespread habitat changes, such as replacement of grasses, forbs, and low shrubs with tall shrubs and trees, which bighorns avoid because of increased predation. Fire exclusion and grazing of domestic livestock make contributions to these habitat changes (Lyon et al. 1995). Disease transmission from domestic sheep to bighorns is also a concern. There are two subspecies of bighorn sheep in the basin—the California bighorn sheep and Rocky Mountain bighorn sheep. It is estimated that there are about 5,000 of the former and 15,000 of the latter in the basin. State wildlife management agencies estimate that there is sufficient vacant historical habitat to double or triple the number of bighorns in the basin. Mountain goats have extended their range into areas where they have not been historically, but some populations have declined for unknown reasons (Marcot et al. 1997). Mountain goats are sensitive to human activity and roads. Moose are gradually increasing in most forest habitats, especially near Canadian moose populations and where transplant programs have been implemented. Poaching can be a limiting factor for moose colonizing new areas.

Like most native big game species, populations of pronghorn antelope were decimated by unregulated hunting between 1850 and 1920. Since then populations have increased because of regulated hunting and improved range conditions. However, available pronghorn populations have been affected by loss of habitat, fire suppression, increases in coyotes and dogs, transportation systems, human habitation, grazing, and fencing that is not compatible with pronghorn movements (Lyon et al. 1995). Populations of this lowland species have become more disjunct (populations have become isolated from each other) and blocks of habitat are becoming islands.

Populations of the bobcat and other fur-bearing species appear to be increasing as demand for their fur decreases. Bobcats have an important interaction with black-tailed jackrabbits and cottontail rabbits in the shrub steppe areas, and may help to reduce crop damage during periods of high jackrabbit population cycles (Collopy and Smith 1995).

Black bears and mountain lions are hunted to a limited extent. Although specific population numbers are not available, indices seem to indicate populations of these species are stable or increasing.

Numerous small game species (grouse, squirrels, turkeys, rabbits) are hunted. Populations of some of these species are felt to be declining and are included as species of focus.

A number of plants are collected for food and other uses. For example, many people collect berries and mushrooms when they are in season. Also, a number of plant species are important to the members of American Indian tribes for food, medicinal, and spiritual purposes. These plants and their uses are presented in Appendix 8.

There is an increasing use of herbaceous plants for commercial purposes. These uses are often for health or medicinal reasons, and the increasing popularity of "natural" remedies is increasing demand for some species. This can have an adverse effect on localized populations of the collected species, although the degree of these effects can not be identified at the broad scale.

Aquatic/Riparian/Hydrologic Component

Key Terms Used in This Section

Anadromous fish — Fish that hatch in freshwater, migrate to the ocean, where they mature in salt water, and return to freshwater to reproduce; for example, salmon and steelhead.

Beneficial Uses — Various uses for water including, but not limited to: domestic water supplies, industrial water supplies, agricultural water supplies, navigation, recreation in and on the water, fish and wildlife habitat, and aesthetics. The beneficial use depends on actual use, the ability of water to support a non-existing use either now or in the future, and its likelihood of being used in a given manner. The use of water for wastewater dilution or as receiving water for waste treatment facility effluent are not considered beneficial uses.

Best Management Practices — Practices designed to prevent or reduce water pollution.

Biotic Integrity — The ability to support and maintain a balanced, integrated, adaptive community of organisms having a species composition, diversity, and functional organization comparable to that of the natural habitat of the region.

Endemic Species — Plants or animals that occur naturally in a certain region and whose distribution is relatively limited to a particular locality.

Extinction — Complete disappearance of a species from the earth.

Extirpation — Loss of populations from all orpart of a species' range within a specified area.

Headwaters — Beginning of a watershed; unbranched tributaries of a stream.

Hybridization — The cross-breeding of unlike individuals to produce hyploid offspring.

Hydrologic — Refers to the properties, distribution, and effects of water. "Hydrology" refers to the broad science of the waters of the earth—their occurrence, circulation, distribution, chemical and physical properties, and their reaction with the environment.

Large Woody Debris — Pieces of wood that are of a large enough size to affect stream channel morphology.

Pools — Portions of a stream where the current is slow, often with deeper water than surrounding areas and with a smooth surface texture. Pools often occur above and below riffles and generally are formed around stream bends or obstructions such as logs, root wads, or boulders. Pools provide important feeding and resting areas for fish.

Refugia — Areas that have not been exposed to significant environmental changes or disturbances undergone by the region as a whole. Refugia provide conditions suitable for survival of species that may be declining elsewhere.

Resident Fish — Fish that spend their entire life in freshwater; examples include bull trout and westslope cutthroat trout.

Riparian areas — Area with distinctive soil and vegetation between a stream or other body of water and the adjacent upland; includes wetlands and those portions of floodplains and valley bottoms that support riparian vegetation.

Salmonid — Fishes of the family Salmonidae, including salmon, trout, chars, whitefish, ciscoes, and grayling.

Sediment — Solid materials, both mineral and organic, in suspension or transported by water, gravity, ice, or air; may be moved and deposited away from their original position and eventually will settle to the bottom.

Sensitive species — Species identified by a Forest Service regional forester or BLM state director for which population viability is a concern either (a) because of significant current or predicted downward trends in population numbers or density, or (b) because of significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution.

Seral — Refers to the stages that plant communities go through during succession. Developmental stages have characteristic structure and plant species composition. In a forest, for example, early seral forest refers to seedling or sapling growth stages; mid seral forest refers to pole or medium saw timber growth stages; and mature or late seral forest refers to mature and old-growth stages.

Strongholds/Strong populations (fish) — Subwatersheds that have the following characteristics: (1) presence of all major life-history forms (for example, resident, fluvial, and adfluvial) that historically occurred within the subwatershed; (2) numbers of fish are stable or increasing, and the local population is likely to be at half or more of its historical size or density; (3) the population or metapopulation of fish within the subwatershed, or within a larger region of which the watershed is a part, probably contains at least 5,000 individuals or 500 adults.

Subbasin — A drainage area of approximately 800,000 to 1,000,000 acres, also called a 4th-field Hydrologic Unit Code (HUC).

Subwatershed — A drainage area of approximately 20,000 acres, also called a 6th-field Hydrologic Unit Code (HUC). Hierarchically, a subwatershed is contained within a watershed, which in turn is contained within a subbasin.

Uplands — The portion of the landscape above the valley floor or stream.

Watershed — 1) The region draining into a river, river system, or body of water. 2) In this EIS, the term watershed also refers specifically to a drainage area of approximately 50,000 to 100,000 acres, which is also called a 5th-field Hydrologic Unit Code (HUC).

Wetlands — In general, an area soaked by surface or groundwater frequently enough to support vegetation that requires saturated soil conditions for growth and reproduction; generally includes swamps, marshes, bogs, wet meadows, mudflats, natural ponds, and other similar areas. For legal definition, see Glossary.

Summary of Conditions and Trends

Aquatic and Riparian Habitats

- Streams and rivers are highly variable across the project area, reflecting diverse physical settings and disturbance histories. Nevertheless, important aspects of stream channel stability, such as channel complexity and large wood abundance, have decreased throughout much of the project area. Aquatic species habitat features such as riffle-pool frequency and wood frequency are generally less in areas with higher road densities and in areas where timber harvest has been a management emphasis.
- The overall extent and continuity of riparian areas and wetlands has decreased, primarily because of conversion to agriculture but also because of urbanization, transportation improvements, and stream channel modifications.
- Riparian ecosystem function, determined by the amount and type of vegetation cover, has decreased in most subbasins within the project area. However, the rate has slowed, and a few areas show increases in riparian cover and large trees.
- Most riparian areas on Forest Service- or BLM-administered lands are either "not meeting objectives", "non-functioning", or "functioning at risk."
- Within riparian woodlands, the abundance of mid seral vegetation has increased, whereas the abundance of late and early seral structural stages has decreased, primarily because of fire exclusion and harvest of large trees.
- Within riparian shrublands, there has been extensive conversion to riparian herblands and increases in exotic grasses and forbs, both primarily because of processes and activities associated with excessive livestock grazing pressure. Finer scale information also indicates an extensive spread of western juniper into riparian shrublands.
- There is an overall decrease in large trees and late seral vegetation in many riparian areas.
- The frequency and extent of seasonal flooding necessary to maintain riparian and wetland function have been altered by changes in flow regime due to dams, diversions, and groundwater withdrawal, and by changes in channel geometry due to sedimentation and erosion, channelization, and installation of transportation improvements such as roads and railroads.

Water Quality

- Management activities throughout the project area have affected water quality, which is important to aquatic habitats and riparian and wetland areas by altering the streamflow, erosion, and sedimentation regimes, and the production and distribution of organic material. On federally administered lands the most pronounced changes to water quality are due to road construction, vegetation alteration (including silvicultural practices, fire exclusion, and forage production), improper livestock grazing, and water diversions and impoundments.
- Water quantity effects on water quality have been locally affected by dams, diversions, and groundwater withdrawal. More subtle but widespread changes in water quantity on federally administered lands have probably been caused by road construction and changes in vegetation due to silvicultural practices and excessive livestock grazing pressure.
- Within the project area, approximately eight percent of stream miles on Forest Service- or BLM-administered lands are water quality limited as defined by the Clean Water Act. On Forest Service-administered lands, the primary water quality problems are non-point sources of pollution consisting of sedimentation, turbidity, flow alteration, and high temperatures. On BLM-administered lands, water quality limited segments are listed because of non-point pollution sources consisting of high sediment, turbidity, and high temperatures.

Aquatic Species

- The composition, distribution, and status of fishes within the project area are different than they were historically. Some native fishes have been extirpated from large portions of their historical ranges.
- Many native nongame fish are vulnerable because of their restricted distribution or fragile or unique habitats.
- Although several of the key salmonids are still broadly distributed (notably the cutthroat trout and redband trout), declines in abundance, loss of life history patterns, local extinctions, and fragmentation and isolation in smaller blocks of high quality habitat are apparent.
- Wild chinook salmon and steelhead are near extinction in a major part of their remaining

distribution, largely because of the construction and operation of mainstem dams on the Columbia and Snake rivers.

- Habitat, hydropower, harvest, hatchery management, and irrigation withdrawals all affect the survival of remaining anadromous fish populations within the interior Columbia River Basin to different extents. Land management activities have affected habitat for wild chinook and steelhead and have limited their spawning and rearing success. The contribution of freshwater habitat to declines in anadromous fish populations would be greatest in the lower Snake and mid-Columbia drainages, and least in the northern Cascades and in central Idaho (for example in wilderness areas and other protected areas), which is affected by the most dams between spawning and rearing areas and the ocean. The influence of hydropower on anadromous fish populations increases upriver, where there are more dams between freshwater spawning and rearing areas and the ocean. Harvest, which has been curtailed in recent years, has less effect on anadromous fish today than it did historically. Hatcheries are an important element throughout the basin, but their effect on native stocks is variable.
- Core areas for rebuilding and maintaining biological diversity associated with native fishes still exist within the project area.

Aquatic/Riparian Health—A Definition

Healthy aquatic and riparian habitats support animal and plant communities that can adapt to environmental changes and follow natural evolutionary and biogeographic processes. Healthy aquatic and riparian systems are resilient and recover rapidly from natural and human disturbance. They are stable and sustainable, in that they maintain their organization and autonomy over time and are resilient to stress, in part because of their high biological diversity and habitat complexity. In a healthy aquatic/riparian system there is a high degree of connectivity from headwaters to downstream reaches, from streams to floodplains, and from subsurface to surface flows. Floods can spread into floodplains, and fish and wildlife populations can move freely throughout the watershed. Healthy aquatic and riparian ecosystems also maintain long-term soil productivity. Rates of erosion vary, but overall soil and nutrient loss do not exceed soil formation rates. There is sufficient vegetation, leaf litter, and large woody debris to allow percolation of rainwater into soils and groundwater without excessive runoff or accelerated rates of erosion. Mineral and energy cycles continue without loss of efficiency.

Healthy watersheds provide numerous ecosystem services to people. These include: (1) high quality and dependable water supplies; (2) moderation of the effects of flooding, drought, and climate change; (3) recharge of stream systems and groundwater aquifers; (4) maintenance of diverse and productive riparian plant communities that trap silt and buffer the high energy of floods; and (5) maintenance of healthy riparian areas that moderate stream temperature by shade and buffer sediment pulses from adjacent hillslopes. The diversity of native fish populations increases in response to ecosystem recovery if recolonization sources are available.

— Adapted from Williams, Wood, and Dombeck 1997

Introduction

This section summarizes the condition of aquatic ecosystems by first characterizing the aquatic habitats, riparian and wetland areas, and water quality of the project area. This is followed by a description of the status of fish species that use and are affected by these environments, focusing on past and current conditions of many fish species in the entire project area. Special attention is given to native fish species, especially wide-ranging salmon and trout species. Aspects of native fishes that are particularly affected by regional-scale management decisions are emphasized. Issues discussed include: (1) current conditions of native, threatened or endangered, and introduced species; (2) condition, status, and trends of key salmonids; (3) biotic and genetic integrity; and (4) subbasin categories.

Hydrologic environments and their key processes and conditions (such as streamflow, sedimentation, erosion, and channel formation) are described earlier in this chapter in the Physical Setting section. Water quality is a key indicator resulting from the physical environment that influences or modifies the physical and biological characteristics of riparian and aquatic ecosystems, and is discussed in this section.

Information in this section is drawn from Hann, Jones, Karl, et al. (1997); Lee et al. (1997); Henjum et al. (1994); Wissmar et al. (1994); and other sources as cited.

Aquatic Habitats

Many aquatic and riparian plant and animal species in the project area have evolved in concert with the dynamic nature of stream channels, developing traits, life-history adaptations, and propagation strategies that allow persistence and success within landscapes that experience harsh disturbance regimes. Figure 2-17, later in this chapter, illustrates how salmon and trout use various portions of a stream during different parts of their life cycles. See the Physical Setting section, earlier in this chapter, for more detailed discussion of stream channel processes, functions, and patterns.

Lee et al. (1997) addresses the current status of stream channel morphology in the project area in relation to management actions through analysis of aquatic habitat inventories. These analyses include resurveys of 120 streams inventoried in the 1930s and 1940s, and more than 6,000 stream inventories completed in the past five years that summarize stream conditions across a spectrum of physiographic environments and management histories. Key findings from analysis of both data sets indicate that stream channel morphology is highly variable, depending on stream type and biophysical environment, but there are major correlations between management intensity and stream channel morphology over time and space.

Aspects of channel morphology in the project area that have apparently been affected by land management practices include the frequency of pools, the frequency of large pieces of wood in the channel, and the composition of substrate (amount of fine sediment). Low gradient (slopes less than two percent) and larger streams are apparently the most sensitive to high road densities and where there is emphasis on timber harvest. Pool frequency and wood frequency are generally less in areas with more management activities. Additionally, where measured, the percent of the channel bed covered with fine sediment (less than 0.25 inches) increases with road density. These findings are consistent with observations from site-specific analyses that indicate that improper road construction, excessive livestock grazing pressure, and timber harvest practices increase delivery of fine sediment to stream channels, filling pools and causing stream aggradation (Furniss et al. 1991; Hicks et al. 1991). For a description of channel morphology across the project area, see Jensen et al. (1997) and Lee et al. (1997) in the *Assessment of Ecosystem Components* (Quigley and Arbelbide 1997).

In addition to changes to streams and rivers such as those discussed in the *Scientific Assessment*, land management practices have caused an overall change in the scale and frequency of landscape disturbance, resulting in a distinctly different character of watersheds and their stream systems when viewed from a regional perspective. Individual and isolated watersheds, riparian areas, and stream channels used to be affected from time to time by large disturbances such as floods, fire, and insect infestations, but other neighboring watersheds remained largely unaffected. Most streams and associated species in the project area evolved with this pulse-like pattern of disturbance. However, past land management practices have led to increased levels of watershed disturbances

Most stream channels are in a somewhat 'unnatural' condition, with habitat conditions that are less than optimal for aquatic and riparian-dependent species.

spread over time and space. Consequently, most watersheds contain stream channels and aquatic habitats that are now subject to cumulative effects of continual rather than periodic watershed disturbance. As a result, most stream channels are in a somewhat 'unnatural' condition, with habitat conditions that are less than optimal for aquatic and riparian-dependent species, which evolved in environments that probably had many more high-quality habitat areas spread across the landscape.

Improving trends in channel conditions have been documented within the project area. For example, in the South Fork Salmon River in Idaho, studies showed a 78 percent reduction in the volume of stored sediment between 1965 and 1989. Excessive sedimentation resulting from a combination of extensive logging, road construction, and wildfire combined with large storm events during the winter of 1964–65, buried prime spawning and rearing habitat in the river. Following a moratorium on logging activities coupled with a watershed restoration and monitoring program, a large volume of fine sediment was moved from the system. Not only was the volume of fine sediment reduced, but the size of particles on the streambed increased, indicating that the sources of sediment have stabilized to some degree (Bohn and Megahan 1991).

Riparian Areas and Wetlands

Background

Riparian areas are water-dependent systems that consist of lands adjacent to streams, rivers, and wetland systems (see Figure 2-15). Riparian ecosystems are the ecological links between uplands and streams, and between terrestrial and aquatic components of the landscape. Riparian areas are defined primarily on the basis of their nearness to lakes, streams, and rivers.

Many riparian areas have *wetlands* associated with them. Wetlands occur wherever the water table is usually at or near the ground, or where the land is at least seasonally covered by shallow water. Wetlands in the project area include marshes, shallow swamps, lake shores, sloughs, bogs, and wet meadows; they are found in both rangeland and forestland environments. Wetlands are an important part of the overall landscape, providing major contributions to ecosystem productivity and structural and biological diversity, particularly in drier climates (Elmore and Beschta 1987).

About 60 percent of the historical wetlands remain within the basin.

Within the project area, wetlands constitute a very small portion of the total land area—less than 1.5 percent. Many wetlands have been drained, filled, pumped dry, or otherwise degraded or lost; about 60 percent of the historical wetlands remain within the basin (compared to a national wetland area of 50 percent of historical remaining). Most of the wetland loss is a result of past draining for agriculture and farming, but smaller wetlands within forest and rangeland riparian areas have been altered or lost from road placement within valley bottoms and other causes.

The largest existing wetland systems in the project area are within the Northern Great Basin and Upper Klamath Basin ERUs, where wetlands occupy the bottoms of closed basins. These large lake/wetland systems naturally shrink and expand in response to climate, and now are also affected by irrigation and water withdrawal. Many small, isolated wetlands exist in alpine areas in the Upper Klamath Basin, Northern Cascades, Southern Cascades, Blue Mountains, and Northern Glaciated Mountains. These wetlands are mostly remnants of small lakes, or have formed in small closed depressions formed by glaciation, landslides, or lava flows.

Physical Processes in Riparian Areas and Wetlands

Important physical processes in riparian areas primarily relate to the interactions among stream channels, adjacent valley bottoms, and riparian vegetation, which depend on the frequency of floodplain inundations (flooding). Water that infiltrates into the floodplain during periods of high flow, returns to the channel during periods of low flow, contributing a cool source of summer base flow for many streams, especially in low-elevation alluvial valleys. Seasonal inundation of the floodplain results in overbank deposition and enrichment of riparian soils. Inundation of the floodplain also reduces water velocities during flooding and helps reduce downstream flood peaks, both factors that reduce the risk of channel

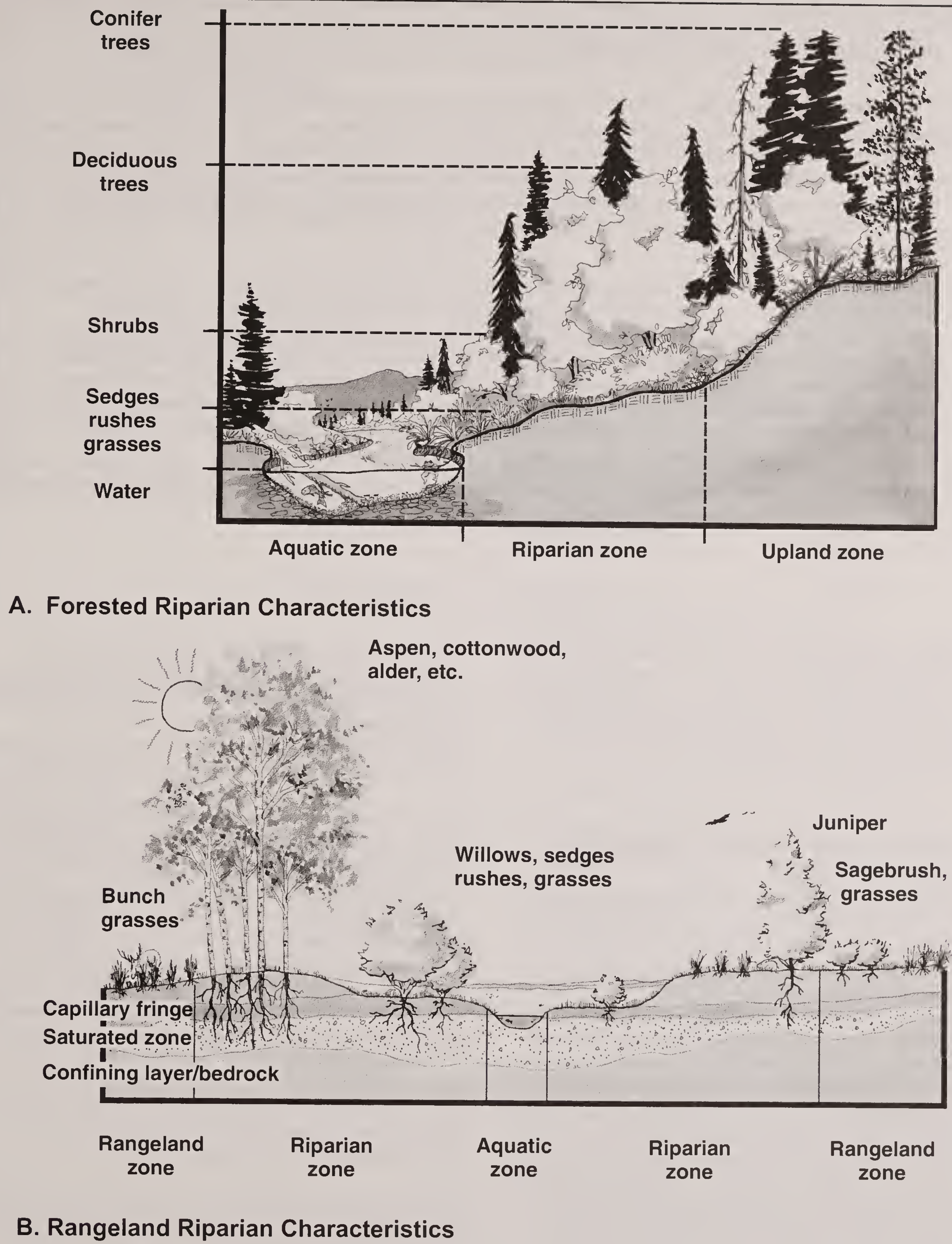


Figure 2-15. Forestland and Rangeland Riparian Characteristics.

Wetlands — A Definition

The U.S. Army Corps of Engineers, Environmental Protection Agency, Fish and Wildlife Service, and Natural Resource Conservation Service worked together to develop common language and criteria for the identification and delineation of jurisdiction wetlands in the United States (Federal Interagency Committee for Wetland Delineation 1989). The four federal agencies defined wetlands as possessing three essential characteristics: (1) hydrophytic vegetation, (2) hydric soils, and (3) wetland hydrology, which is the driving force creating all wetlands. The three technical characteristics specified are mandatory and must all be met for an area to be identified as a wetland.

"Hydrophytic vegetation" is defined as plant life growing in water, soil, or on a substrate that is at least periodically deficient in oxygen as a result of excessive water content. "Hydric soils" are defined as soils that are saturated, flooded, or ponded long enough during the growing season to develop anaerobic (without oxygen) conditions in the upper part of the soil profile. Generally, to be considered a hydric soil, there must be saturation at temperatures above freezing for at least seven days. "Wetland hydrology" is defined as permanent or periodic inundation, or soil saturation to the surface, at least seasonally. The presence of water for a week or more during the growing season typically creates anaerobic conditions in the soil, which affects the types of plants that can grow and the types of soils that develop (Hansen et al. 1995).

erosion. Inland wetlands perform many of the same functions, such as detaining storm runoff, reducing flow peaks and erosion potential, retaining and filtering sediment, and augmenting groundwater recharge by storing water and releasing it more slowly, later into the dry season.

Riparian and Wetland Vegetation

Most riparian and wetland areas within the project area stand out because of their unique vegetation. In drier regions, ribbons of dense vegetation flank streams and rivers, in distinct contrast to the surrounding uplands and valley bottoms.

Riparian vegetation plays a role in many physical processes within riparian areas. Vegetation shades streams and moderates water temperatures by helping keep waters cool in the summer and providing an insulating effect in the winter. Densely vegetated riparian areas buffer the input of sediment from hillslopes and filter fertilizers, pesticides, herbicides, and sediment from runoff generated on adjacent lands. Riparian vegetation also promotes bank stability and contributes organic matter and large woody debris to some stream systems, which is an important component of instream habitat (Gregory et al. 1991; Henjum et al. 1994; Hicks et al. 1991; Kovalchick and Elmore 1992; Sedell et al. 1990). Complex off-channel habitats, such as backwaters, eddies, and side channels, are often formed by the interaction of streamflow and riparian features such as living vegetation and large woody debris (Gregory et al. 1991). These areas of slower water provide critical refuge during floods for a variety of aquatic species, and serve as rearing areas for juvenile fish.

The broad-scale analysis of vegetation (Hann, Jones, Karl, et al. 1997) identified three potential vegetation groups associated with riparian areas: riparian woodland (dominated by cottonwood, aspen, ponderosa pine, and Douglas-fir), riparian shrub (dominated by alder and willow), and riparian herb (including sedges, forbs, and grasses; see Table 2-25). Because riparian vegetation grows in thin strips along streams and rivers, it was difficult to accurately determine the extent of riparian area using a broad-scale analysis during the *Assessment*. To augment the broad-scale analysis, 337 subwatersheds within 43 subbasins were randomly selected for further analysis on riparian vegetation trends (Hessburg et al. 1995; Hessburg et al. in press).

Under natural conditions, riparian plant communities have a high degree of structural and compositional diversity, reflecting the history of past disturbances such as floods, fire, wind, grazing, plant disease, and insect outbreaks (Gregory et al. 1991). Historically, disturbance regimes along riparian areas were dominated by floods and fires, with some grazing by native ungulates (large, hoofed mammals, such as

Table 2-25. Cover Types-Structural Stage Combinations Within Terrestrial Communities Within the Riparian Potential Vegetation Groups (PVGs), and Associated Terrestrial Families.

Terrestrial Community	Cover Type	Structural Stage	Terrestrial Family
Riparian Herb PVG			
Riparian Herbland Terrestrial Community	Herbaceous Wetlands	Closed Herbland	5, 10, 11, 12
Upland Herbland Terrestrial Community	Native Forbs	Closed Herbland	5, 8, 10, 12
Riparian Shrub PVG			
Riparian Shrubland Terrestrial Community	Shrub Wetlands	Closed Low Shrub	3, 5, 6, 7, 12
		Open Low Shrub	3, 5, 6, 7, 12
		Closed Tall Shrub	3, 5, 6, 7,12
Riparian Herbland Terrestrial Community	Herbaceous Wetlands	Closed Herbland	5,10, 11, 12
		Open Herbland	5, 10, 11, 12
Upland Herbland Terrestrial Community	Wheatgrass Bunchgrass	Closed Herbland	3, 5, 8, 10, 12
Upland Shrubland Terrestrial Community	Salt Desert Shrub	Open Mid Shrub	5, 7, 10, 11
Exotic Herbland	Exotic Forbs/ Annual Grass	Open Herbland	10
Riparian Woodland PVG			
Riparian Woodland Terrestrial Community	Aspen	Stand-initiation Forest	2, 3, 4, 5, 6, 7, 8
		Stem Exclusion Closed Canopy Forest	3, 5, 7
		Understory Reinitiation Forest	2, 3, 5, 6, 7
		Young Multi-story Forest	unmanaged: 2, 3, 5, 6, 7 managed: 3, 5, 7
	Cottonwood/Willow	Stand-initiation Forest	2, 3, 5, 6, 7
		Stem Exclusion Closed Canopy Forest	5, 6, 7
		Understory Reinitiation Forest	3, 5, 6, 7
		Young Multi-story Forest	unmanaged: 1, 2, 5, 6, 7 managed: 1, 5, 6, 7
Riparian Shrubland Terrestrial Community	Shrub Wetlands	Closed Mid Shrub	3, 5, 6, 7, 12
		Open Mid Shrub	3, 5, 6, 7, 12
	Closed Tall Shrub		3, 5, 6, 7, 12
Mid Seral Lower Montane Forest	Interior Ponderosa Pine	Understory Reinitiation Forest	2, 3, 5, 6, 7
Late Seral Lower Montane Single Story Forest		Old Single Story Forest	1, 2, 3, 5, 6, 7, 8
Late Seral Lower Montane Multi-story Forest		Old Multi-story Forest	1, 2, 3, 5, 6, 7
Early Seral Montane Forest	Shrub or Herb/ Tree Regen	Closed Mid Shrub	2, 3, 5
Mid Seral Montane Forest	Interior Douglas-fir	Young Multi-story Forest	unmanaged: 2, 3, 5, 6, 7 managed: 3, 5, 6, 7
Late Seral Montane Multi-story Forest	Interior Douglas-fir	Old Multi-story Forest	1, 2, 3, 5, 6, 7
Upland Herbland	Fescue-Bunchgrass	Closed Herbland	5, 8, 10, 12
Exotic Herbland	Exotic Forbs/Annual Grass	Closed Herbland	10

Source: Developed from Hann, Jones, Karl, et al. 1997 (Appendices 3A, 3B, 3F); and Wisdom et al. (in press).

deer, elk, and antelope). Within the riparian woodland potential vegetation group, fires were normally infrequent but severe (lethal or mixed), occurring at 65- to 150-year recurrence intervals when there were appropriate weather, fuel, and ignition conditions (Hann, Jones, Karl et al. 1997). Flood cycles historically occurred on 10- to 20-year intervals, with floods on larger streams less frequent. In the riparian shrub potential vegetation group, fire was typically more frequent, occurring every 25 to 50 years. Most of these fires were non-lethal or mixed. Historically, flood cycles occurred at 20- to 30-year intervals, with floods on larger streams less frequent. Hann, Jones, Karl, et al. (1997) did not report disturbance interval information for the riparian herb potential vegetation group.

Current Conditions and Trends: Riparian Areas and Wetlands

Riparian Areas

Key broad-scale trends identified in Hann, Jones, Karl, et al. (1997) include a reduction in riparian area abundance and an increase in habitat fragmentation and simplification within the project area. The riparian woodland potential vegetation group declined slightly (less than one percent) from historical. While this trend was confirmed by Hessburg et al. (1995), they also reported *increases* in woodlands in some regions of the project area because of conversion of riparian shrubland to juniper stands. However, although the riparian woodland did not decline substantially in area, the diversity of its terrestrial communities has declined. Historically, approximately 60 percent of the riparian woodland was composed of mid seral terrestrial communities. Currently, mid seral terrestrial communities make up nearly 90 percent of the riparian woodland. Fire suppression, timber harvest, and possibly declines in flood frequency on larger streams were causes of this shift.

The riparian shrubland potential vegetation group has declined 80 percent within the project area (Hann, Jones, Karl, et al. 1997). Analysis conducted by Hessburg et al. (1995) confirmed this declining trend, which occurred mainly on non-BLM- or Forest Service-administered lands because of excessive livestock grazing pressure, invasion of exotic plants, and agricultural and urban developments. Additionally, some loss is the result of succession into forest cover types such as juniper, ponderosa pine, and Douglas-fir, mainly from fire exclusion. No information was reported for the riparian herb potential vegetation group.

Hessburg et al. (in press) conducted further analysis on the distribution and extent of riparian and wetland areas within the project area. They compared vegetation changes over a 40- to 60-year time period using aerial photographs. Within the project area, they sampled 337 randomly selected subwatersheds mainly dominated by Forest Service- or BLM-administered lands. Results indicated that the extent of riparian and wetland vegetation declined in nonforest areas while it increased in forested areas. They concluded that the increase in riparian and wetland extent was due to fire suppression which allowed valley bottom and adjacent side slope vegetation to develop and express itself in the absence of disturbance.

In the western United States, 66 percent of inventoried BLM-administered riparian areas are either "non-functioning" or "functioning at risk."

In addition to geographical extent, functionality (such as water storage and shade) is another important component of riparian areas. In the western United States, 66 percent of inventoried BLM-administered riparian areas are either "non-functioning" or "functioning at risk" as defined in the process for assessing Proper Functioning Condition (see sidebar). Likewise, more than 75 percent of riparian areas administered by the Forest Service in the western United States are not "meeting or moving toward objectives" (USDI BLM 1994b).

Large trees within riparian areas make up an important functional component. Large trees provide valuable habitat for many riparian-dependent terrestrial species, and they provide shade and aquatic habitat. Hessburg et al. (1995) analyzed the extent of large trees within riparian areas over a 40- to 60-year time interval within the project area. They reported a general trend toward reduction in large riparian trees primarily through timber harvest.

Riparian vegetation plays an important role in stream process and function.

Photo by Doug Basford.

Proper Functioning Condition - A Definition

In response to the growing concerns over the integrity of ecological processes in many riparian areas and wetlands, the BLM has developed a process for assessing "Proper Functioning Condition." The BLM's Riparian-Wetland Initiative for the 1990s (USDI BLM 1991a and 1993) establishes national goals and objectives for managing riparian-wetland resources on BLM-administered lands. This initiative's two-part goal is to: (1) restore and maintain existing riparian-wetland areas so that 75 percent or more are in Proper Functioning Condition, and (2) to achieve and provide the widest variety of habitat diversity for wildlife, fish, and watershed protection.

Riparian-wetland areas achieve Proper Functioning Condition when adequate vegetation, landform, or large woody debris is present to dissipate stream energy associated with high water flows. This thereby reduces erosion and improves water quality; filters sediment, captures bedload, and aids floodplain development; improves floodwater retention and groundwater recharge; develops root masses that stabilize streambanks against cutting action; develops diverse ponding and channel characteristics to provide habitat and water depth, duration, and temperature necessary for fish production, waterfowl breeding, and other uses; and supports greater biodiversity. The functioning condition of riparian-wetland areas is a result of the interaction among geology, soil, water, and vegetation (USDI BLM 1993). Proper functioning condition can exist anywhere along the seral continum, from early seral to potential natural community depending upon the characteristics of the riparian-wetland area (Hann, Jones, Karl, et al. 1997). Although proper functioning condition is viewed by the BLM as the minimum acceptable condition, management objectives might require vegetation composition, cover, or structure that are representative of advanced seral states. Achievement of advanced ecological status, high similarity to potential natural community, is the ultimate goal on federal rangeland riparian-wetland areas (Barrett et al. 1993 as cited in Hann, Jones, Karl, et al. 1997; U.S. Department of Interior 1990 as cited in Hann, Jones, Karl, et al. 1997).

On Forest Service- or BLM-administered lands within the project area, major factors contributing to the decrease in riparian area function are: excessive livestock grazing pressure, timber harvesting, fire management, conversion to crop and pastureland, road development, and dams, diversions, and/or pumping. On rangelands, excessive livestock grazing pressure has been the most important factor affecting riparian areas. On forested landscapes, silvicultural practices (including fire suppression) and road building have had the highest effects on riparian areas. To a lesser extent, disturbances associated with recreational uses, urban development, and mining have also contributed to the decrease in functioning riparian areas.

Although declining riparian conditions occur in many areas, over the past decade land management agencies working cooperatively with the land users have concentrated restoration efforts in riparian areas, and many areas are recovering. An example of improved rangeland riparian condition is the Big Cottonwood Creek watersheds on the Sawtooth National Forest in Idaho, where an improving trend has occurred in the past five to seven years (see photos). Bare soil and muddy wet areas are now covered with grasses, with wetlands being created and willows growing along the streambank. The improvement has resulted from improved management by the permittees.

Wetlands

Since European settlement, many wetlands on private lands have been drained, filled, sprayed with herbicides and pesticides, or logged, primarily to develop lands for agriculture, but also for residential, commercial, and industrial development. Additionally, wetland habitats have been affected by the invasion of non-native plants (such as purple loosestrife, saltcedar, and Russian olive) and introduced animals (such as bullfrogs). On many sites, these non-native species have become well established, commonly replacing native species or exerting large influences on the functional dynamics of existing native habitats.

Most of the remaining high quality wetlands in the project area are on BLM- or Forest Service-administered lands, primarily in alpine or sub-alpine environments, and on other federally managed lands such as National Wildlife Refuges managed by the U.S. Fish and Wildlife Service. Artificial wetlands also contribute significantly to wetland habitats within the project area. These areas, such as Malheur Lake in eastern Oregon and those in the Columbia Plateau, were created by flow impoundment, irrigation ponds, stream diversion, and agricultural wastewater.

Water Quality

Background

As specified in the Clean Water Act, water quality includes those attributes that affect existing and designated uses of a water body. Included are human uses such as recreation, hydropower, and water supply, and other uses such as maintenance of fisheries and riparian habitats. As a result, water quality attributes that are considered under the Clean Water Act include traditional physical and chemical constituents such as pH, bacteria concentration,

Water Quality and the Clean Water Act

Water quality is regulated by state environmental agencies under authority granted by the Clean Water Act (1972) and subsequent amendments. Under the Clean Water Act, federal agencies are, in general, required to meet state requirements. In the upper Columbia River Basin, the Forest Service and BLM are the responsible management agencies for water quality on lands they manage, as described in memoranda of understanding (MOUs) with state environmental agencies. These MOUs require federal agencies to meet water quality standards, monitor activities to assure they meet standards, report results to the states, and meet periodically to recertify Best Management Practices (BMPs), which are practices designed to prevent or reduce water pollution. The primary mechanisms for regulating and controlling non-point sources of pollution are adopting and implementing (1) Best Management Practices, (2) numeric and narrative water quality standards, and (3) the antidegradation policy (40 CFR 131).

Big Cottonwood Creek — Then and Now

Photo by USFS/Sawtooth NF.

1986. Big Cottonwood Creek, Twin Falls Ranger District. Mature trees are mostly dead, and there is no regeneration of willow or cottonwood due to heavy browsing by cattle.

Photo by USFS/Sawtooth NF.

1990. Total rest in 1988 and 1989 and light fall use in 1990 allowed release of willow and cottonwood.

Photo by USFS/Sawtooth NF.

1992. Light use in the spring of 1991, and spring use in 1992. 400 cow-calf pairs used this unit for 10 days just prior to this photo being taken.

temperature, discharge, and factors relevant to aquatic habitat such as the abundance of large woody debris, pool frequency, and riparian canopy density.

Water temperature is a water quality parameter considered under the Clean Water Act and is a regionally important facet of aquatic habitat required to support beneficial uses on Forest Service- and BLM-administered lands within the project area. The relationship between land use practices, water temperature, and effects on fish species is better understood than for any other aspect of water quality (Rhodes et al. 1994). Water temperature influences metabolism, behavior, and mortality of aquatic species (Beschta et al. 1987; Bjornn and Reiser 1991). Salmonids (salmon and trout) are cold-water fish that are particularly sensitive to increases in temperature; sustained water temperatures of higher than 64 to 80 degrees Fahrenheit are lethal for most species.

On public lands in the basin, non-point sources of pollution are the primary cause of degraded water quality. A non-point source of pollution is water pollution whose source(s) cannot be pinpointed, but that can be best controlled by proper soil, water, and land management practices.

The Clean Water Act requires each state to review all available information on water quality every two years as part of a statewide water quality assessment. Where application of current Best Management Practices (BMPs) or technology-based controls are not sufficient to achieve designated water quality standards, the water body is classified as "water quality limited." Water bodies having impaired water quality are in part identified on the respective states' 303(d) lists. A protocol for addressing restoration and maintenance of 303(d) waters on BLM- and -Forest Service administered lands was developed collaboratively and adopted for the area included in the project area. Application of this 303(d) protocol would provide reasonable assurance that listed and threatened waters, as well as waterbodies not meeting water quality standards, will be addressed in a consistent manner at an appropriate scale and level of technical rigor. This protocol was developed and adopted after publication of the ICBEMP Draft EISs.

Current Conditions and Trends: Water Quality

About 10 percent of the streams and rivers within the project area are potentially water quality limited. Approximately 8 percent of stream mileage on Forest Service- and BLM-administered lands are listed as potentially water quality limited and, therefore, not in full support of beneficial uses (Lee et al. 1997).

On Forest Service-administered lands in the project area, the primary water quality concerns are sedimentation and turbidity, flow alteration (water quantity), and high water temperatures during summer months. On BLM-administered lands, high sediment and turbidity levels and high temperatures are the primary reasons for listing as water quality limited.

In the project area, where summer air temperatures are generally much higher than 80 degrees Fahrenheit, many streams have lost their capability to support cold-water fish, and salmonid mortality due to elevated water temperatures is common in streams that still support salmonids (Henjum et al. 1994).

Fish and Other Aquatic Species

Background

Fish are the dominant aquatic vertebrates and constitute a key component of aquatic ecosystems in the project area (Figure 2-16). Fish are a critical resource to humans and have influenced the development, status, and success of social and economic systems within the project area. Fish are sensitive to disturbance, thus including the effects of landscape and watershed processes over large regions. The diversity and integrity of native fish communities provide useful indicators of aquatic ecosystem structure, function, and health.

Current Conditions and Trends: Aquatic Species

Like many portions of western North America, the project area has a moderately sized, locally diverse fish fauna. The varied characteristics and distribution of native fishes mirror the diverse and dynamic physiography and geologic history of the region. The native fish fauna of the Columbia River drainage is unusual in that it is not a single unit, but rather is composed of several subbasin faunas with limited species overlap among subbasins. There are presently 143 recognized fish species, subspecies, or races reported within the project area.

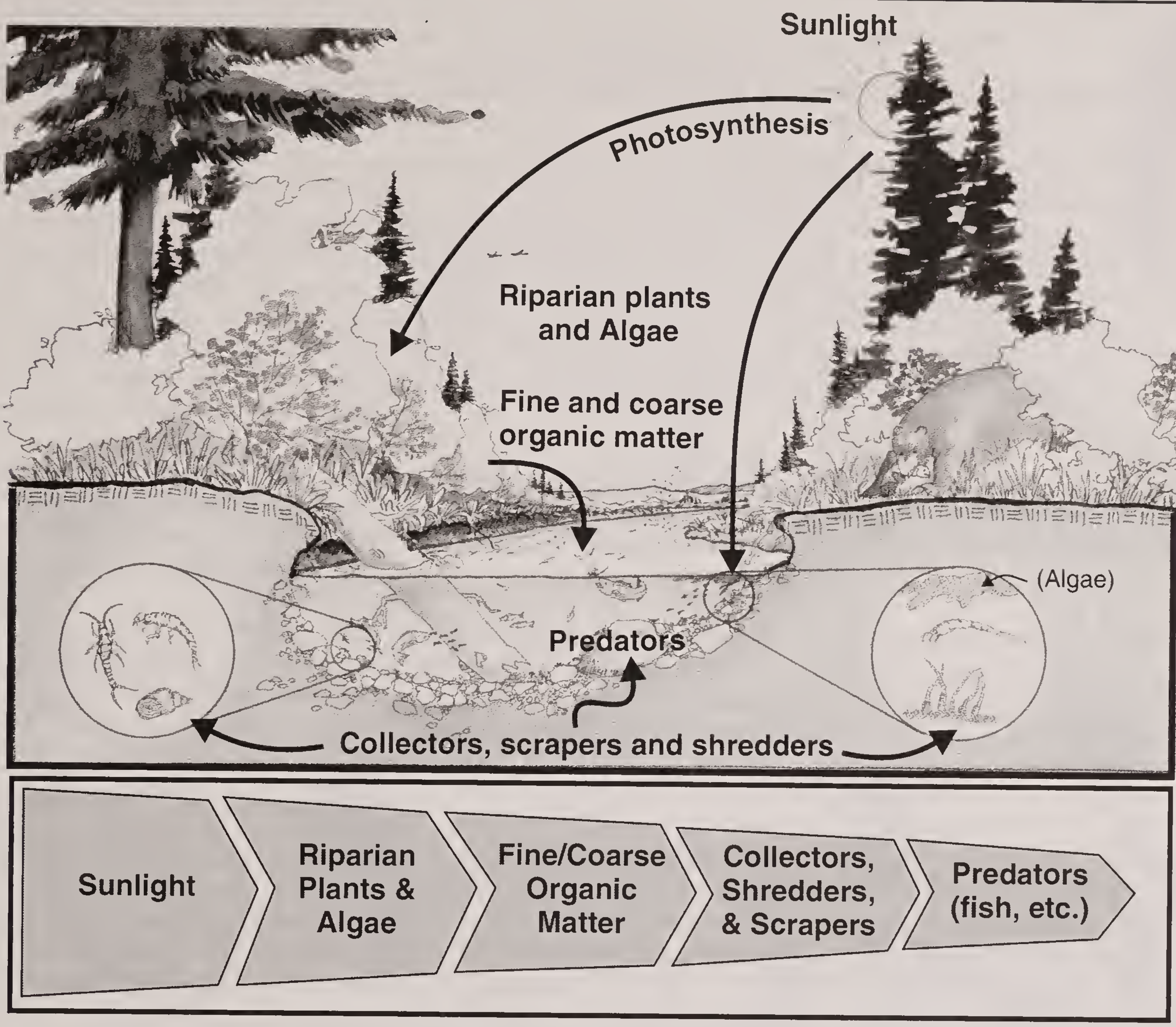


Figure 2-16 Aquatic Food Web. Fish are key components of aquatic ecosystems, where complex food webs include both aquatic and terrestrial plants and animals.

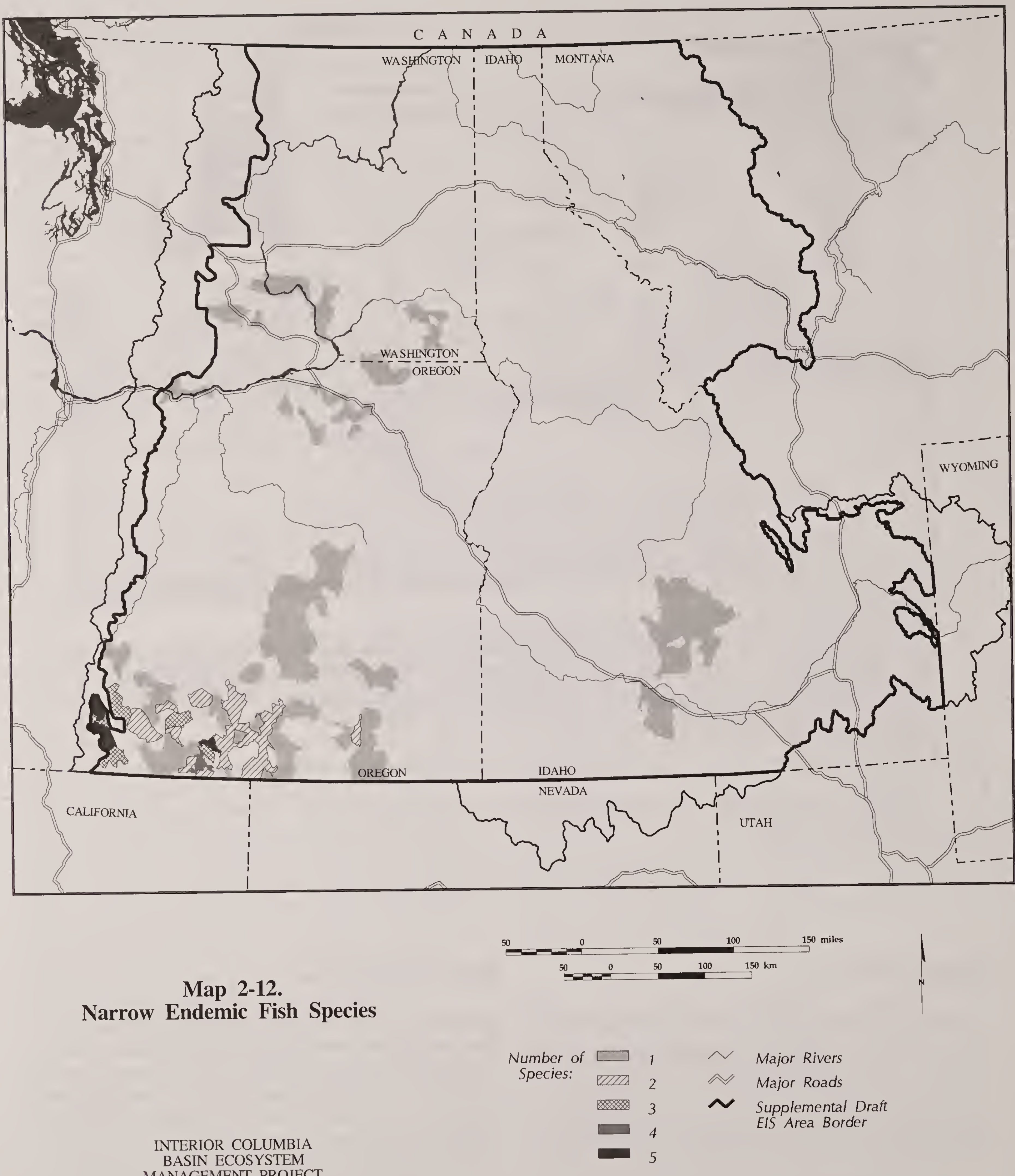
Native Species

Eighty-eight of the project area fish species are native. Compared to other large river systems, species richness (number of species) within the project area is quite low, which may be a reflection of the isolation and geologic history of the project area compared to other large river basins with greater species richness.

In individual watersheds (5th-field Hydrologic Unit Codes) within the project area, the total number of native species ranges from zero to 28. The largest number of native species is found in the large river corridors, particularly the lower and mid-Columbia and lower Snake rivers. Fewer native fish species are found in headwater watersheds in the Blue Mountains and western Montana.

Narrow Endemics

Native fish species tend to fall into two groups. The first group consists of 15 to 20 species that are widely distributed throughout the basin or are reported in 20 percent or more of the project area. The second group of roughly 60 species includes the narrow endemic or rarer species that have restricted ranges or are infrequently reported. These species are generally found in less than five percent of the project area. These species, commonly called narrow endemic species, are found principally in Oregon and southern Idaho. Many of these species are associated with closed basins or are isolated in relatively small watersheds. See Map 2-12.



Map 2-12.
Narrow Endemic Fish Species

INTERIOR COLUMBIA
BASIN ECOSYSTEM
MANAGEMENT PROJECT

Supplemental Draft EIS Area
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The History of Forest Service/BLM Fish Habitat Management

Federally managed lands in the Columbia River Basin contain more than 60 percent of the remaining accessible spawning and rearing habitat for anadromous salmonids. In response to the evidence for declining populations, and the importance of Forest Service- and BLM-administered lands for maintenance and rebuilding of existing populations, these agencies have developed and implemented several strategies intended to maintain and enhance anadromous fish habitat. Another goal of these plans was to meet the goals and objectives of the Northwest Power Planning Council (NWPPC), which was chartered in 1981 to restore a sustainable anadromous fishery within the Columbia River Basin. The Forest Service and BLM have cooperated with the NWPPC, the Bonneville Power Administration (BPA), state fish and game agencies, and tribal governments in an effort to manage anadromous fish habitats.

The Forest Service and BLM have existing land use plans, many that were prepared prior to 1990, which address anadromous and resident fish habitat management. These plans are not species- or watershed-specific. They provide for Forest Service and BLM management to maintain and enhance habitat and to meet existing federal laws such as the Clean Water Act.

In January 1991, the Forest Service developed a Columbia River Basin Anadromous Fish Policy, which set forth a consistent plan for management of anadromous fish habitat within the Columbia River Basin. The policy contained a policy implementation guide, which outlined procedures for establishing objectives for anadromous fish production, described desired future conditions, identified habitat inventory needs, and developed monitoring strategies. This policy is still in place but will be replaced by direction from the Record of Decision developed from this EIS.

The PACFISH strategy, a joint document signed by the Chief of the Forest Service and the Director of the BLM in February 1995, outlines and establishes a strategy for anadromous fish habitat management. PACFISH establishes interim goals and objectives, identified riparian conservation areas and associated protective standards to guide management activities that may damage those areas, outlines monitoring requirements to track how well agencies follow the standards, and evaluates the effectiveness of these measures.

An inland native fish strategy (INFISH) was developed and implemented in July 1995 by the Forest Service to protect resident fish outside of anadromous fish habitat in eastern Oregon, eastern Washington, Idaho, western Montana, and portions of Nevada. The Bureau of Land Management instituted the interim direction and guidelines of INFISH to be applied to BLM lands containing bull trout habitat within the Columbia River Basin in October 1995. This strategy is similar in content to PACFISH.

Both PACFISH and INFISH are interim direction until long-term direction is developed through the ICBEMP Environmental Impact Statement and Record of Decision.

Map 1-3 in Chapter 1 illustrates areas affected by PACFISH and INFISH.

In addition to PACFISH and INFISH, several programmatic Biological Opinions have been completed by the National Marine Fisheries Service and the U.S. Fish and Wildlife Service which provide further guidance for federally listed fish habitat management on large portions of Forest Service- and BLM- administered lands within the project area. These Biological Opinions were completed as a result of Section 7 consultation required by the Endangered Species Act. The Forest Service and BLM must comply with the terms and conditions contained within Biological Opinions when implementing management activities in listed fish habitat. In Chapter 3, Alternative S1 includes these Biological Opinion requirements.

The Upper Klamath and Agency lakes harbor a diverse community of specialized catostomid (sucker) fishes. The Great Basin contains multiple subbasins which have been isolated from each other and the ocean since the Pleistocene Age, approximately 1.6 million years ago. Each basin is now characterized by largely or wholly internal drainage, resulting in highly endemic fish faunas. The distinctive native fishes of both the upper Klamath Basin and Great Basin portions of the project area bear little resemblance to those of the Columbia River Basin. For further information on narrow endemic fish species see Lee et al. (1997). Appendix 2-1 in the Eastside Draft EIS contain maps showing the historical and current distributions of these narrow endemic fish.

Special Status Native Aquatic Species

There are 47 special status fish species in the project area. Special status species include federally listed endangered or threatened species; federal candidate species for listing; species recognized for special protection by the states of Oregon, Washington, Idaho, or Montana; species managed as sensitive species by the Forest Service and/or BLM; and species recognized by the American Fisheries Society. Excluding the widely distributed salmonids, the list of special status species in the project area includes: the white sturgeon (*Acipenseridae*); 5 lampreys (*Petromyzontidae*); sockeye, chum and coho salmon (*Salmonidae*); coastal and Lahontan cutthroat trout (*Salmonidae*); pygmy whitefish (*Salmonidae*); burbot (*Gadidae*); 11 minnows (*Cyprinidae*); 6 suckers (*Catostomidae*); 8 sculpins (*Cottidae*); and Sunapee char, an important introduced species. Twenty-two of these species occur in the Great Basin and Klamath Basin portions of the project area. Within the Columbia River Basin, eight occur entirely or primarily in the mainstream river system, three are restricted to the upper Snake River system (including the Wood River in Idaho), two are restricted to the upper Columbia River (primarily in the Northern Glaciated Mountains), two occupy streams in the middle and upper Columbia Basin, and one is restricted to the Blue Mountains in the middle Columbia River Basin.

Sixteen fish species or species stocks in the project area are formally listed under the Endangered Species Act and one qualifies for listing (candidate species: coho salmon). Within the project area, seven of these species or species stocks are listed as endangered: white sturgeon (Kootenai River), sockeye salmon (Snake River), chinook salmon (Upper Columbia River), steelhead (Upper Columbia River), Borax Lake chub, Lost River sucker, and shortnose sucker. Nine species or species stocks are listed as threatened: steelhead (Snake River and Mid Columbia), fall chinook salmon (Snake River), spring/summer chinook salmon (Snake River), bull trout, Hutton tui chub, Foskett speckled dace, Warner sucker, and Lahontan cutthroat trout.

Six aquatic snails federally listed as endangered or threatened are found in the project area (Frest and Johannes 1995), including the endangered Banbury Springs lanx (*Lanx* sp.), Snake River physa (*Physa natricina*), Idaho springsnail (*Fontelicella idahoensis*), Bruneau hot springsnail (*Pyrgulopsis bruneauensis*), and Utah valvata (*Valvata utahensis*); and the threatened Bliss Rapids snail (*Taylorconcha serpenticola*). According to Frest and Johannes (1995), the lanx, Bliss Rapids snail, and Utah valvata may occur on BLM-administered lands in Idaho. All of these three latter species are local endemics with limited distribution and numbers; the major threats to these species are linked primarily to agriculture and river impoundments. A recovery plan has been developed and approved for five listed Snake River snails that includes delineation of recovery areas.

Major Changes from Draft EISs

Aquatic Species

Since publication of the Draft EISs, bull trout; Snake River, Mid Columbia River, and Upper Columbia River steelhead; and Upper Columbia chinook salmon have been listed under the Endangered Species Act (ESA). See Table 2-24 in the Terrestrial Species section of this chapter. As a result of Section 7 consultation, Biological Opinions were completed or are nearing completion for large portions of Forest Service- and BLM-administered lands within the project area. These Biological Opinions provide further guidance for federally listed fish habitat management.

For additional changes from the Draft EISs, see the box in the Introduction to Chapter 2.

Many factors contribute to the current condition of depressed populations and reduced distribution of special status native aquatic species. Hydroelectric development disrupts migration of anadromous forms. Irrigation diversions and water withdrawal, and the loss of wetlands, marshes, and interconnected waterways, alter habitats for many species, especially in arid regions. Silvicultural practices, excessive livestock grazing pressure, and urbanization degrade habitat by changing flow patterns, changing patterns of sedimentation and erosion, increasing water temperatures, and causing increased levels of organic matter resulting in water pollution. Especially threatened are those species dependent on springs, such as the Foskett speckled dace and the Hutton tui chub. Introduced species also have affected native fish by competition, predation, or hybridization.

Management of many special status species is hindered by a lack of information on species distribution, life history, and habitat characteristics. The best available information is for the salmonids, or for a few select species that have attracted the attention of researchers. More detailed information for wide-ranging salmonids is presented in a subsequent section.

Introduced Species

In addition to the native fishes, 55 species of non-native fish species now occupy the project area. Most of these non-native species have been purposely introduced to promote sport fishing opportunities. Introduced salmonids (such as hatchery rainbow trout), centrarchids (such as bass and sunfish), and percids (such as walleye) now support much, if not most, of the sport fishing opportunity in the project area. The introduced species are now permanent components of the aquatic ecosystem and have social and economic importance. They tend to be well-adapted to altered conditions in aquatic environments and have contributed to the decline of native fish and other native aquatic organisms through competition, predation, and hybridization.

Some of these non-native fish species are now widespread. The most frequently reported fish species in the project area is the introduced rainbow trout, occupying 78 percent of the project area watersheds. Introduced brook trout are also well distributed, occupying 50 percent of the watersheds in the project area. Sixteen of the 50 (32 percent) most-reported species are introduced game fishes.

Recreation centered on non-native fisheries is highly valued within the project area, and many watersheds support important wild trout fisheries for introduced salmonids such as brook, brown, rainbow, and lake trout. Habitat in these watersheds remains suitable for natural reproduction of salmonids, although native salmonids may be depressed or extinct because of displacement by non-native fish. For example, in the Henry's Fork of the Snake River, Idaho, native Yellowstone cutthroat trout are virtually extinct in large portions of their historical range, yet wild, self-sustaining populations of introduced rainbow trout thrive and support an internationally recognized trophy trout fishery. Similarly, the upper Deschutes River in Oregon is a renowned wild trout fishery of non-native brook, brown, rainbow, and lake trout, which have partially displaced native salmonids.

Salmonids

Historical Overview

Salmon, perhaps more than any other single resource, have helped define the Pacific Northwest. Historically, salmon occurred in nearly every stream and river not blocked by major falls. Most American Indians in the project area share a major dependence on salmon and other native fish species as a subsistence and ceremonial resource. Subsequent treaties with some American Indian tribes recognized this major dependence and contained language reserving rights for fishing and the harvest of fish. When the first European settlers arrived during the early 1800s, salmon were abundant and diverse. Estimates of historical run size for all species of salmon and steelhead in the Columbia River range from 10 to 16 million adults. The first commercial cannery operations began on the Columbia in 1866 and soon exceeded sustainable levels. Commercial catches of chinook salmon peaked during 1883, when 43 million pounds of fish were landed. Coho, sockeye, chum, and steelhead were also abundant in the Columbia River Basin. The catch of coho salmon peaked at 6.8 million pounds in 1895, whereas the catch of sockeye and steelhead peaked at 4.5 million and 4.9 million pounds respectively (see Lee et al. 1997; Haynes and Horne 1997).

Overfishing was blamed for broad declines in chinook salmon runs by the late 1800s, and by 1900 certain fishing gear was banned to provide some protection to spawning runs. By that time, however, impacts from mining, timber harvest, excessive livestock grazing pressure, and agriculture (including irrigation diversions) had begun. Construction of massive mainstream dams and dams on smaller streams followed. During and immediately after World War

"Strong" Populations and "Strongholds"

For this discussion, "strong" populations or "stronghold" subwatersheds for key salmonids have the following characteristics:

1. All major life-history forms that historically occurred within the subwatershed are present;
2. Numbers are stable or increasing and the local population is likely to be at half or more of its historical size or density;
3. The population or metapopulation within the subwatershed, or within a larger region of which the subwatershed is a part, probably contains at least 5,000 individuals or 500 adults.

II, timber harvest and road building rapidly increased. Urbanization pressures, river channelization, pollution, and other impacts from the increasing human population began to become evident by the 1960s, as numerous stocks of all species of salmon, steelhead, and sea-run cutthroat trout declined.

Mainstream dams and hydropower operations currently are cited as dominant factors in the decline of the region's anadromous fisheries. Hydroelectric development changed the Columbia and Snake river migration corridors from mostly free-flowing in 1938 to a series of impoundments by 1975, and reservoir storage activities have reduced flows in most years during smolt migration. Major dams in the project area are shown on Map 2-13.

Many resident salmonids (non-anadromous forms such as bull trout), which are not subject to the hydropower operations, are also declining. However, bull trout, once widely distributed in central Oregon, Washington, Idaho, and western Montana has been listed as threatened under the Endangered Species Act. Strong and genetically pure populations of westslope cutthroat trout now occupy only a fraction of their range in the project area. Redband trout within the Columbia Basin are poorly understood, yet many subbasins appear to contain declining populations of genetically unique strains. Such significant declines in resident stream salmonid populations indicate broad changes in aquatic conditions within the project area. Overall changes in the distribution of salmonid species are portrayed on Map 2-14 and Map 2-15.

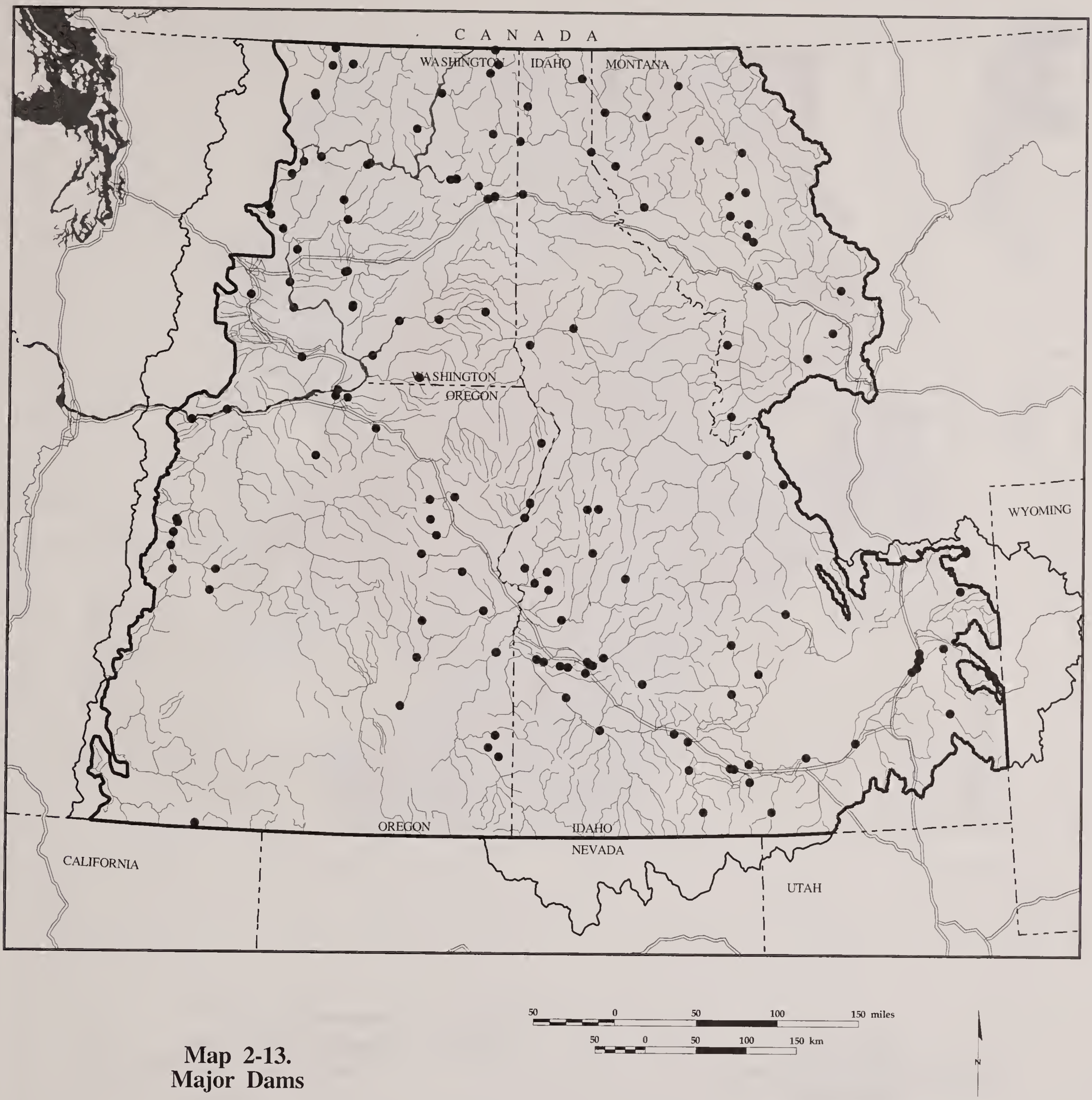
Key Salmonids

Bull trout, westslope cutthroat trout, Yellowstone cutthroat trout, redband trout, steelhead, and stream-type chinook are "key salmonids" that were selected by the Science Integration Team as being broadly representative of the state of aquatic biota in the project area. The Broad-scale Assessment of Aquatic Species and Habitats (Lee et al. 1997) focused on this select group of salmonids for several reasons:

1. This group of fishes has important social and cultural values;
2. Knowledge about these fishes is greater than for other species, and thus environmental relationships are likely to be more apparent;
3. These fishes are widely distributed, which allows for broad-scale comparisons;
4. Salmonids act as predators, competitors, and prey on a variety of other aquatic and terrestrial species, and are therefore likely to influence the structure and function of aquatic ecosystems, and may serve as links to energy and nutrient flows with terrestrial systems;
5. Different salmonid species and different life stages of a species often use widely divergent habitats that expose individual populations to a wide variety of threats, thus integrating cumulative effects of environmental change over broad areas; and
6. The status of these key salmonids can be thought of as a general indicator of aquatic ecosystem health. Problems encountered by these species probably can be assumed to be similar to those facing many aquatic species throughout the project area.

Bull Trout

Bull trout are listed under the Endangered Species Act as threatened in the Columbia and Jarbidge river basins and endangered in the Klamath River Basin. Bull trout are found in many of the major river systems within the project area, but spawning and



Map 2-13.
Major Dams

INTERIOR COLUMBIA
BASIN ECOSYSTEM
MANAGEMENT PROJECT

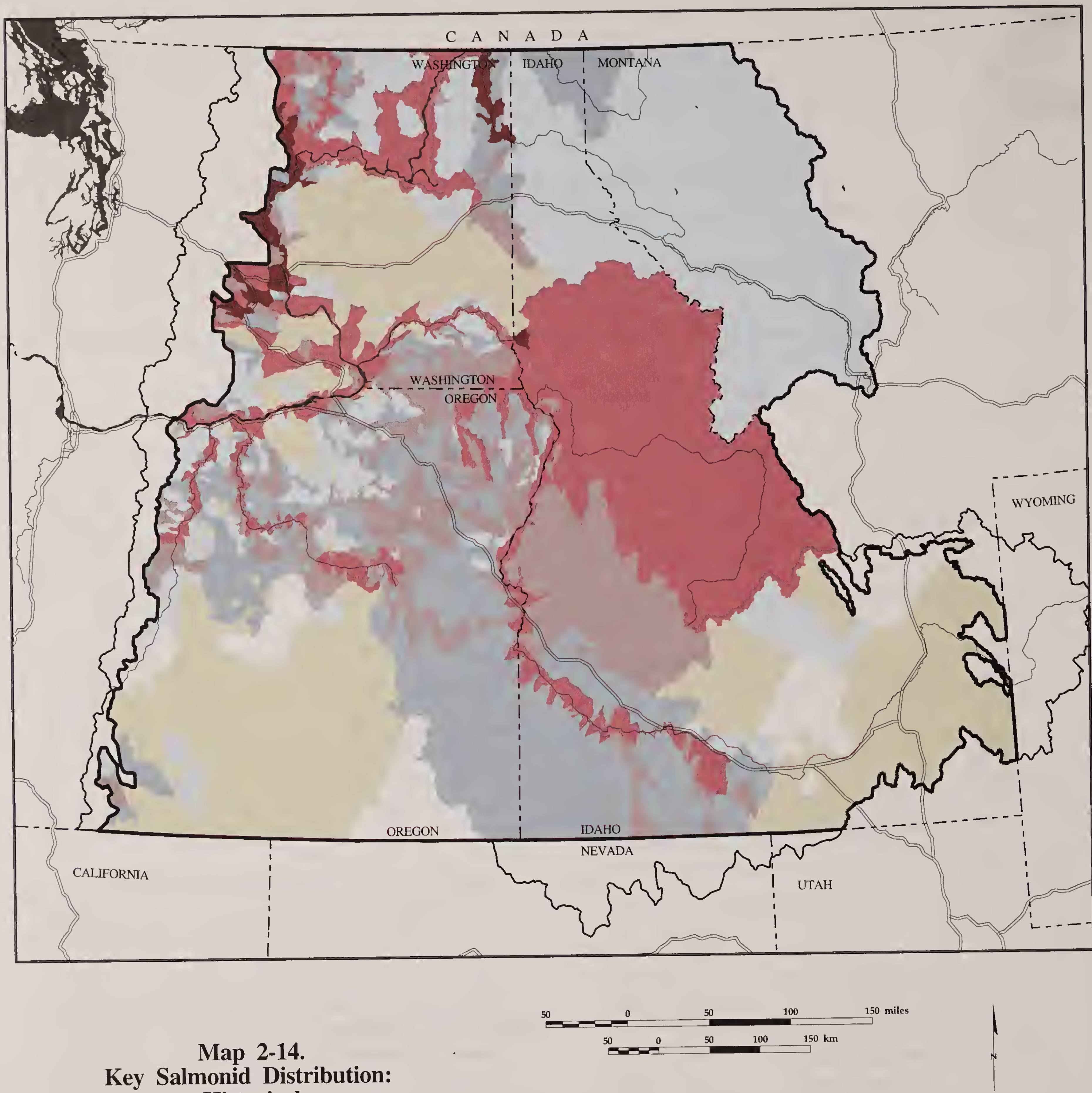
Supplemental Draft EIS Area
2000

Dam Location (Capacity > 50 acre feet)

Major Rivers

Major Roads

Supplemental Draft EIS Area Border



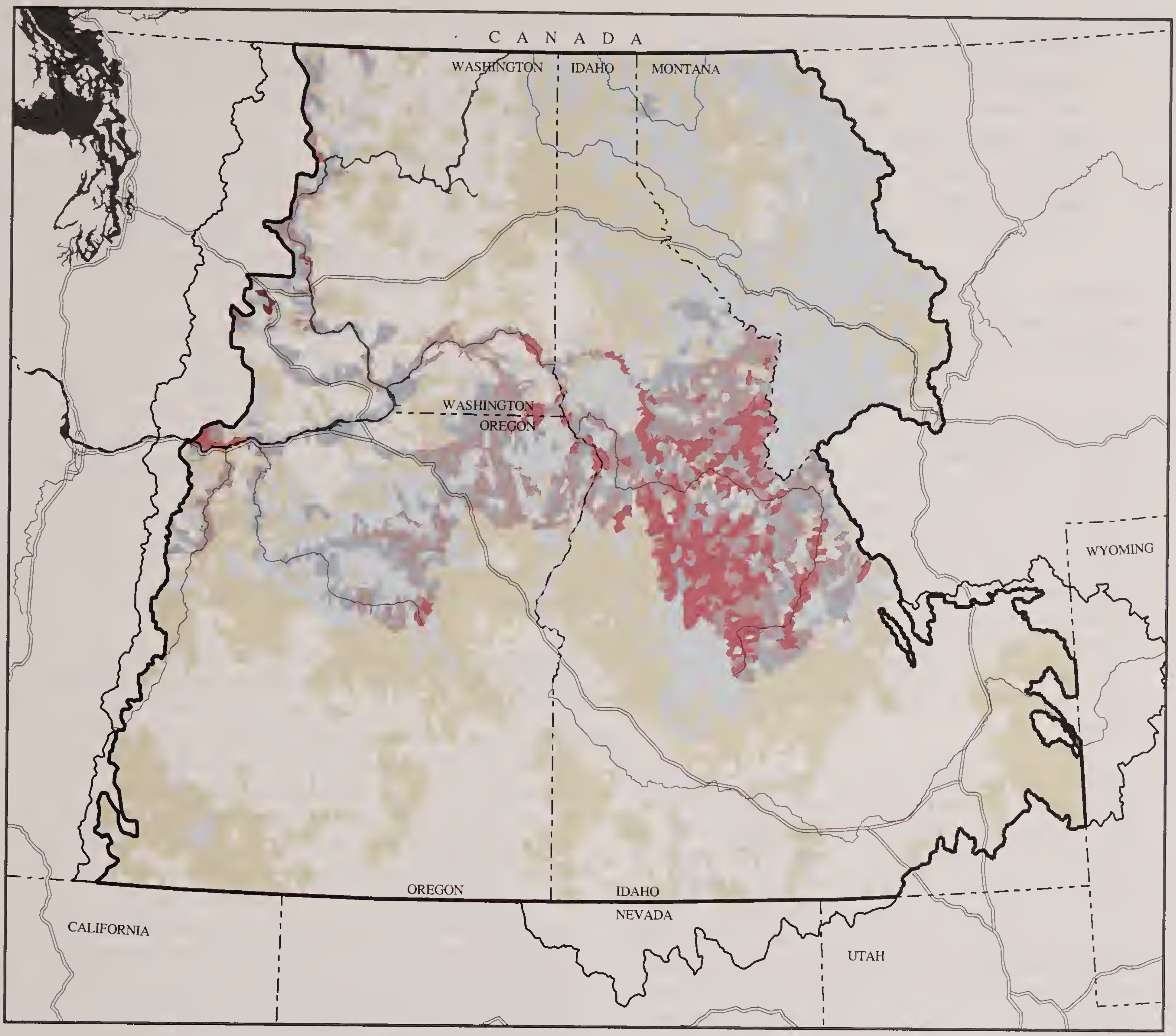
Map 2-14.
Key Salmonid Distribution: Historical

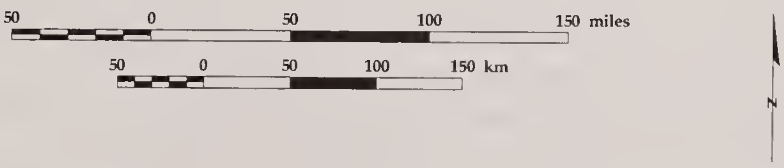
INTERIOR COLUMBIA BASIN ECOSYSTEM MANAGEMENT PROJECT

Supplemental Draft EIS Area
2000

Number of Species: 1, 2, 3, 4, 5, 6

Major Rivers
Major Roads
Supplemental Draft EIS Area Border





**Map 2-15.
Key Salmonid Distribution:
Current**

Number of Species:
1
2
3
4
5
6

Major Rivers
Major Roads
Supplemental Draft EIS Area Border

INTERIOR COLUMBIA
BASIN ECOSYSTEM
MANAGEMENT PROJECT

Supplemental Draft EIS Area
2000

Historically, bull trout populations were well connected throughout the Columbia River Basin. Habitat available to bull trout has been fragmented, and in many cases, entirely isolated.

rearing populations are believed to be primarily restricted to cold and relatively pristine waters, often headwaters, of most rivers. Current and historical distributions of bull trout are illustrated on Map 2-16.

The historical range of bull trout is restricted to North America. Within the project area, bull trout have been recorded in the upper Klamath River Basin in Oregon, and throughout much of interior Oregon, Washington, Idaho, and western Montana. With the exception of the Little Lost and Big Lost rivers, bull trout are not known in the Snake River basin above Shoshone Falls. It is estimated that the historical range of bull trout included about 60 percent of the project area. It is unlikely, however, that bull trout occupied all accessible streams at any one time because of climate and habitat selection.

Bull trout are presently known or estimated to occur in 44 percent of historically occupied watersheds. Bull trout are still widely distributed throughout the project area, with the largest population blocks in north central Idaho and northwestern Montana. The core of the remaining bull trout distribution is tied to the Central Idaho Mountains, with important strongholds still evident or likely within the Upper Clark Fork, Northern Glaciated Mountains, Lower Clark Fork, and Blue Mountains ERUs. Bull trout in the Owyhee Uplands represent an important area of genetic diversity. A small population exists in the Jarbidge River, which represents the present southern limits of the species range. Current information indicates that despite its relatively broad distribution, this species has experienced widespread decline. There is evidence of declining trends in some populations, and recent extirpations of local populations have been reported. Distribution of existing populations is often patchy, even where numbers are still strong and habitat is good.

Spawning and rearing of bull trout appear to be limited to the coldest streams or stream reaches. The lower limits of habitat used by bull trout are strongly associated with gradients in elevation, longitude, and latitude that may approximate a gradient in climate across the project area. The patterns indicate that variation in climate has influenced and will strongly influence habitat available for bull trout. While temperatures are probably suitable throughout much of the northern portion of the range, spawning and rearing habitat is restricted to increasingly isolated high elevation or headwater "islands" toward the south.

Management-related changes influencing stream temperatures and hydrologic regimes are all likely to be important to some, if not most, populations. Populations are likely to be most sensitive to changes in headwater areas encompassing critical spawning and rearing habitat and remnant populations.

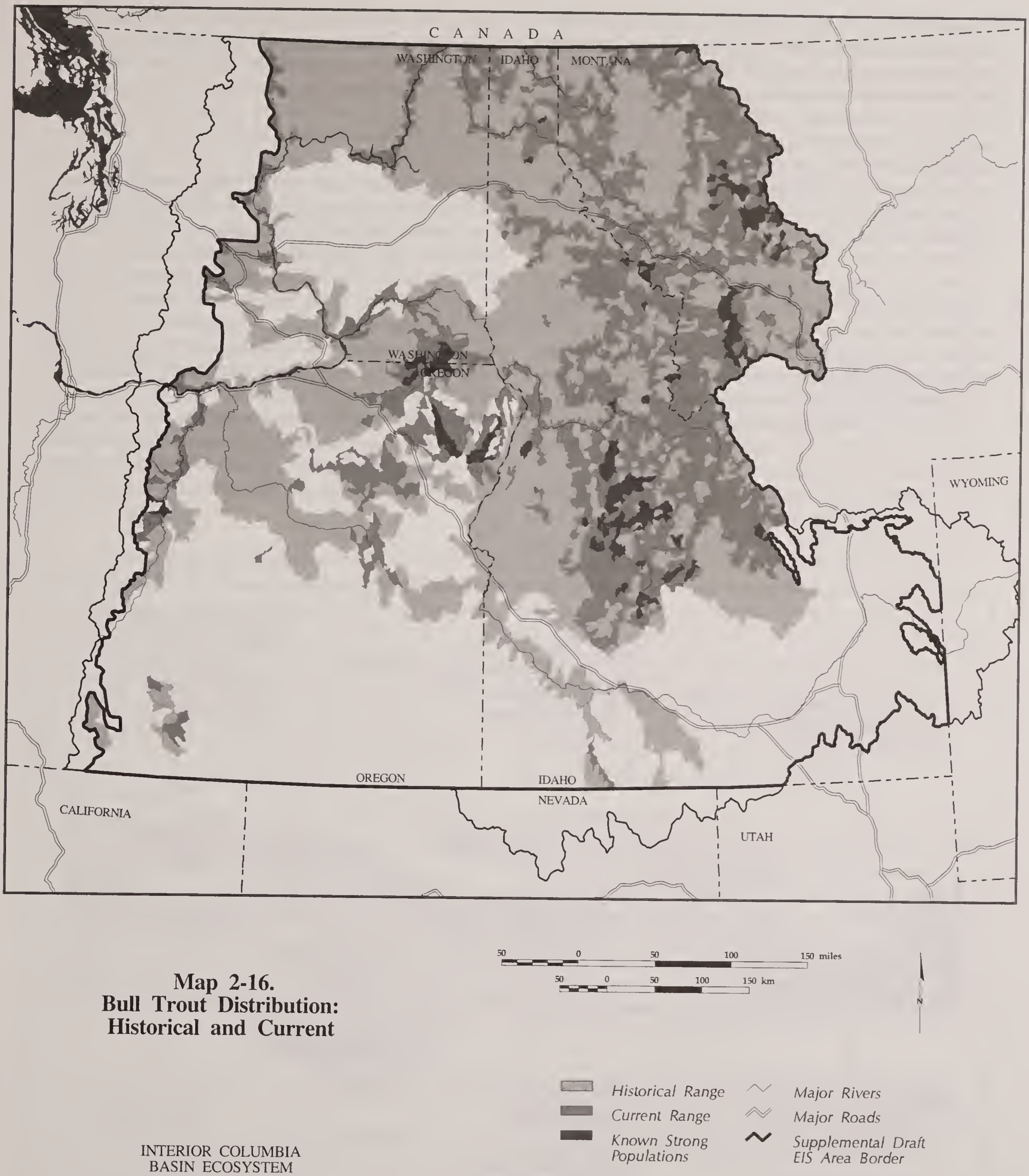
More than 30 non-native species occupy the present distribution of bull trout. Brown trout, brook trout, and lake trout have probably depressed or replaced many local bull trout populations. Brook trout are an especially important competitor and may progressively displace bull trout through hybridization and a higher reproductive potential. Brook trout now occupy the majority of watersheds representing the current range of bull trout. These non-native fish may pose the most risk to native species at sites where habitat has been affected by other disturbances.

Historically, bull trout populations were well connected throughout the Columbia River Basin. Habitat available to bull trout has been fragmented, and in many cases, entirely isolated. Dams have isolated whole subbasins throughout the project area. Irrigation diversions, culverts, and degraded mainstem habitats have eliminated or seriously affected migratory corridors, thus depressing migratory populations and effectively isolating remnant populations in headwater tributaries. Loss of suitable habitat through watershed disturbance may also increase the distance between quality habitats and between strong populations, thus reducing the likelihood of effective dispersal and gene mixing. Further isolation of populations will probably lead to increasing rates of extinction that are disproportional to the simple loss of habitat area.

Yellowstone Cutthroat Trout

The Yellowstone cutthroat trout is more abundant and inhabits a larger geographical range than any other non-anadromous subspecies of cutthroat trout in the western United States. Yellowstone cutthroat trout were historically found throughout the Yellowstone River drainage in Montana and Wyoming and in the Snake River drainage in Wyoming, Idaho, Utah,

Yellowstone cutthroat trout support the largest proportion of strong populations of any key salmonid in the project area.



Map 2-16.
Bull Trout Distribution: Historical and Current

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Nevada, and probably Washington. It is the only native trout in the Snake River above Shoshone Falls. Its historical range included primarily the Upper Snake and Snake Headwaters where 74 percent and 98 percent, respectively, of the watersheds once supported Yellowstone cutthroat trout. Individual populations of Yellowstone cutthroat trout have evolved numerous life-history characteristics in response to the diverse environments in which they have been isolated since the Pleistocene ice age.

There has recently been a substantial reduction in the distribution of this subspecies, and many unique local populations have been lost. As a result, the Yellowstone cutthroat trout has been designated as a "Species of Special Concern - Class A" by the American Fisheries Society. This status has been officially recognized by the Montana Department of Fish, Wildlife, and Parks. The Yellowstone cutthroat trout is recognized as a "Species of Special Concern" in Idaho. Both the Northern and Rocky Mountain regions of the Forest Service and BLM consider the Yellowstone cutthroat trout a sensitive species. Yellowstone cutthroat trout have been petitioned for listing under the Endangered Species Act. Current and historical distributions of Yellowstone cutthroat trout are illustrated on Map 2-17.

Within the project area, Yellowstone cutthroat trout are presently the most narrowly distributed of the key salmonids. The current known and estimated distribution includes 70 percent of its historical range within the project area. The core population is in the Snake Headwaters. Populations are widespread in the Upper Snake, but most are depressed. Remaining populations on the western edge of the range appear to be isolated in small areas. Population declines and losses have been most common in low elevation, higher order streams, as illustrated by the current distribution and status of Yellowstone cutthroat trout in the Upper Snake. Remoteness of portions of the native range probably contributes to the preservation

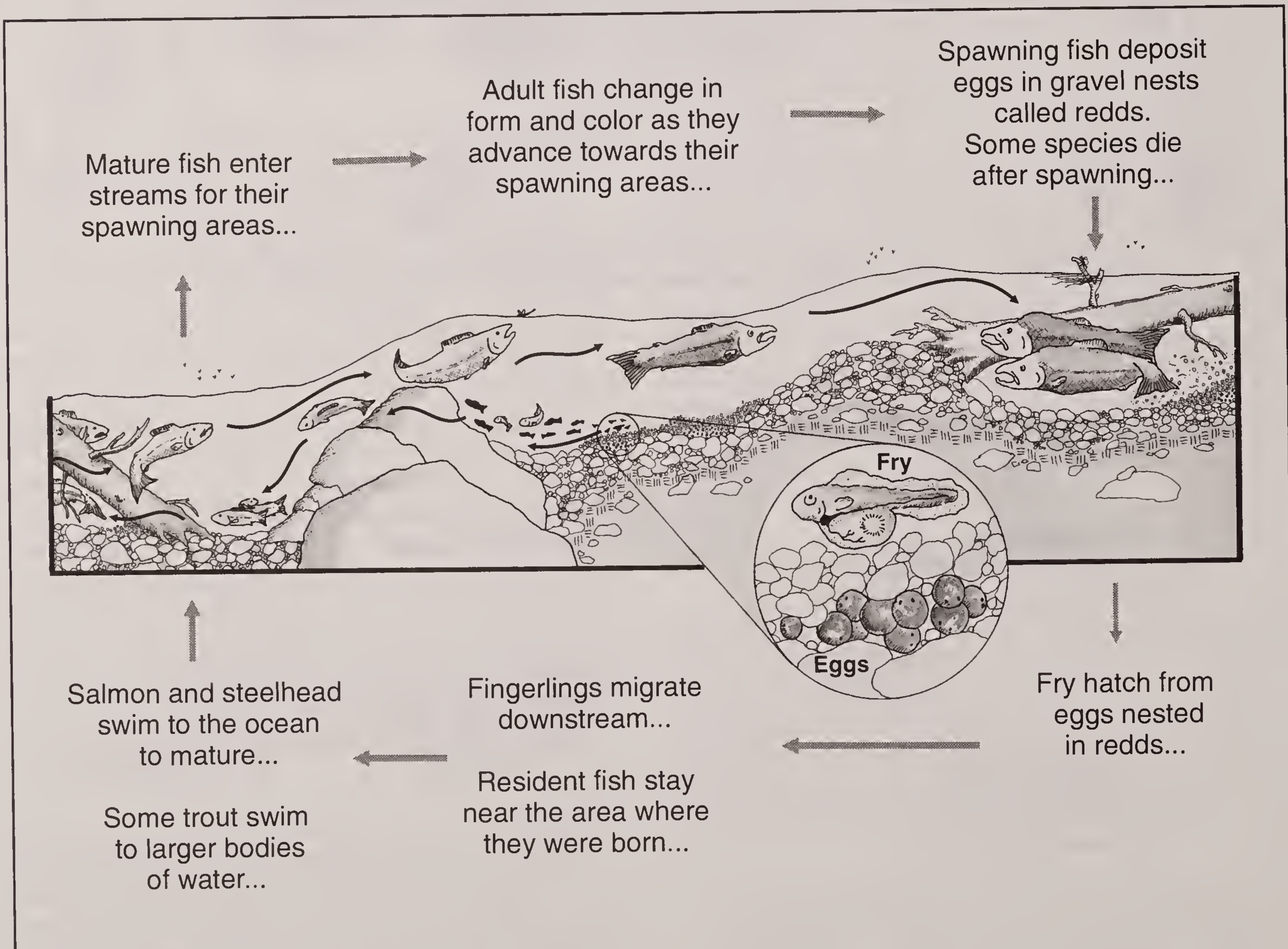


Figure 2-17. Salmon and Trout Life Cycles. Salmon and trout are among the aquatic species whose life cycles have evolved in concert with the dynamic nature of stream channels. All of their life history forms must be present for a subwatershed to be considered "strong."

of remaining populations. Many of these publicly owned portions of the native range, in the form of parks and reserves, have provided habitat protection that is lacking in low elevation portions of the range.

Despite their narrow distribution, Yellowstone cutthroat trout are judged to support the largest proportion of strong populations of any key salmonid. These estimates of strong populations may be misleading because of high probability of hybridization in most populations. Hybridization resulting from introductions of rainbow trout and non-native subspecies or populations of cutthroat trout is the primary cause of the decline and extirpation of Yellowstone cutthroat trout. Genetically unaltered populations of Yellowstone cutthroat trout occur in approximately 10 percent of their historical stream habitats and approximately 85 percent of their historical lake habitats. Approximately 90 percent of the present range of genetically unaltered Yellowstone cutthroat trout is within Yellowstone National Park.

Human activities such as dam construction, water diversions, improper livestock grazing, mineral extraction, road construction, and timber harvest have degraded stream environments throughout the historical range of Yellowstone cutthroat trout. Recreational use can also be a source of disturbance. In the range of this species, excessive livestock grazing pressure on private and public lands in the upper Snake River Basin has caused degradation of riparian areas, including stream bank erosion and channel instability.

Westslope Cutthroat Trout

Westslope cutthroat trout were once abundant throughout much of the north and central interior Columbia River Basin. Although still widely distributed, remaining populations may be seriously compromised by habitat loss and hybridization. They are presently considered a sensitive species by the Forest Service and BLM, and of special concern by state management agencies in Washington, Oregon, Idaho, and Montana. Westslope cutthroat have been petitioned for listing under the Endangered Species Act and is currently under status review by the U.S. Fish and Wildlife Service. Current and historical distribution of westslope cutthroat trout are illustrated on Map 2-18.

Westslope cutthroat trout had the largest historical distribution of all subspecies of cutthroat trout. Cutthroat trout were first recorded by the Lewis and Clark expedition. From early explorer accounts, it is believed they were extremely abundant. Where habitat was suitable and watersheds were accessible, westslope cutthroat trout were commonly found. Westslope cutthroat trout probably also occupied most of the large natural lakes within their range. The historical range of westslope cutthroat trout encompassed about 35 percent of the project area.

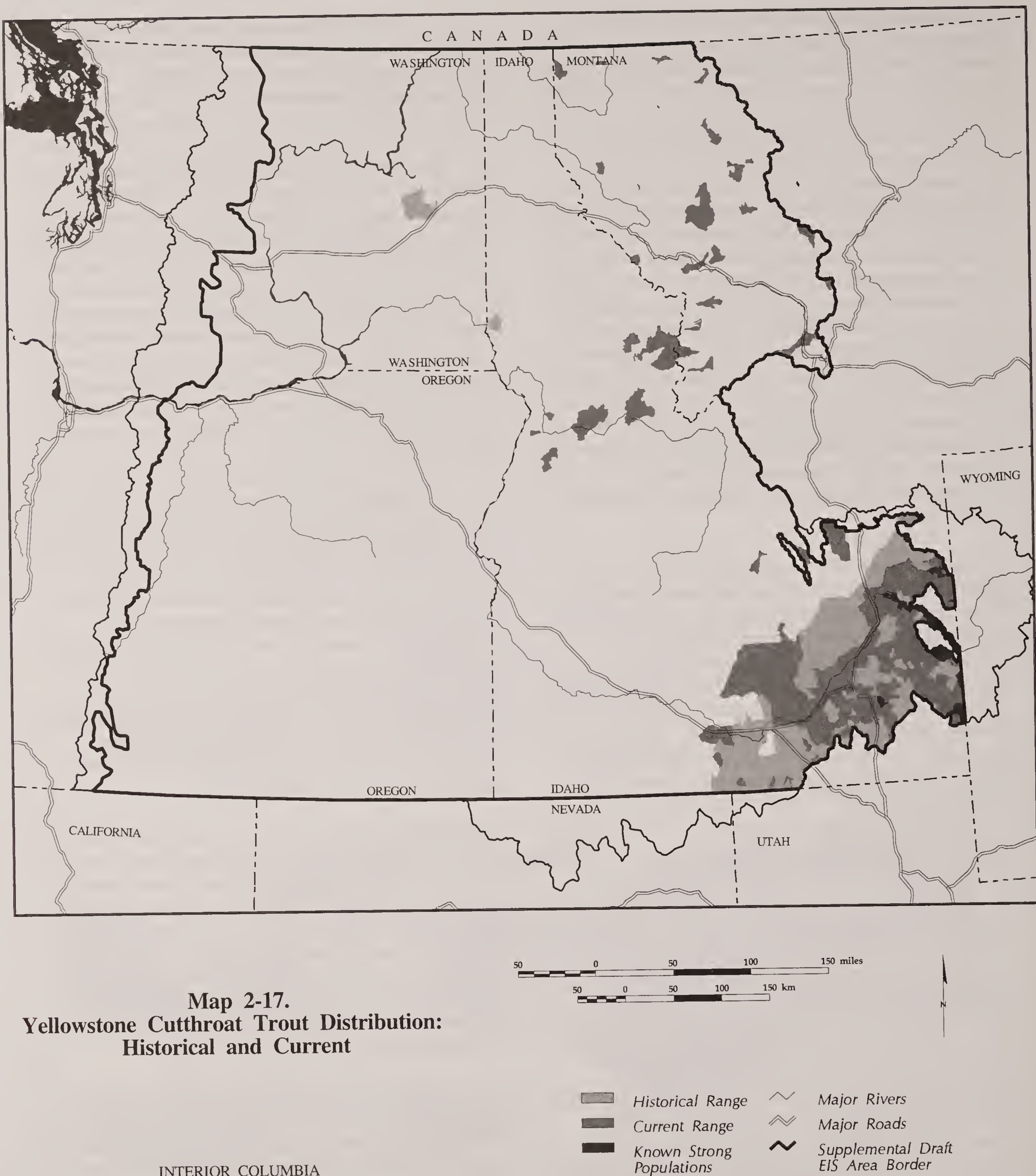
Westslope cutthroat trout are still widely distributed within their historical range, with some extension through hatchery introductions. It is estimated that westslope cutthroat trout are still present in at least 85 percent of their historical range. This broad distribution suggests that, overall, westslope cutthroat trout are secure, but this conclusion must be tempered by uncertainty regarding the genetic integrity of remaining populations. Most current wild populations are depressed, and hybridization, fragmentation, and the loss of migratory populations have limited healthy populations to a much smaller proportion of their historical range.

The core of the distribution for strong populations is associated with the Central Idaho Mountains, where many populations do appear secure. Other important blocks of known or likely habitat are in the Upper Clark Fork and Northern Glaciated Mountains ERUs, although these areas are more fragmented and populations are restricted to a relatively small portion of the historical distribution. The Northern Cascades may support important populations of westslope cutthroat trout which are geographically distinct from the main distribution. Westslope cutthroat trout probably were never widely distributed within the Blue Mountains or Columbia Plateau.

Cutthroat trout and rainbow trout are closely related, but they have remained reproductively distinct where they co-evolved. Where non-native rainbow trout have been introduced, hybridization is widespread. Yellowstone cutthroat have also been introduced into much of the westslope cutthroat trout range, and hybridization is common between these two subspecies. Hybridization was believed to be the most important cause for decline of westslope cutthroat trout populations in Montana.

The westslope cutthroat trout is also a prized game fish, and fishing has probably led to the elimination of some small populations, especially migratory fish in some river systems. Consequently, special harvest

Most existing strong populations of westslope cutthroat trout are largely in roadless and wilderness areas or national parks, suggesting that human disturbances have influenced distribution and abundance.



**Map 2-17.
Yellowstone Cutthroat Trout Distribution:
Historical and Current**

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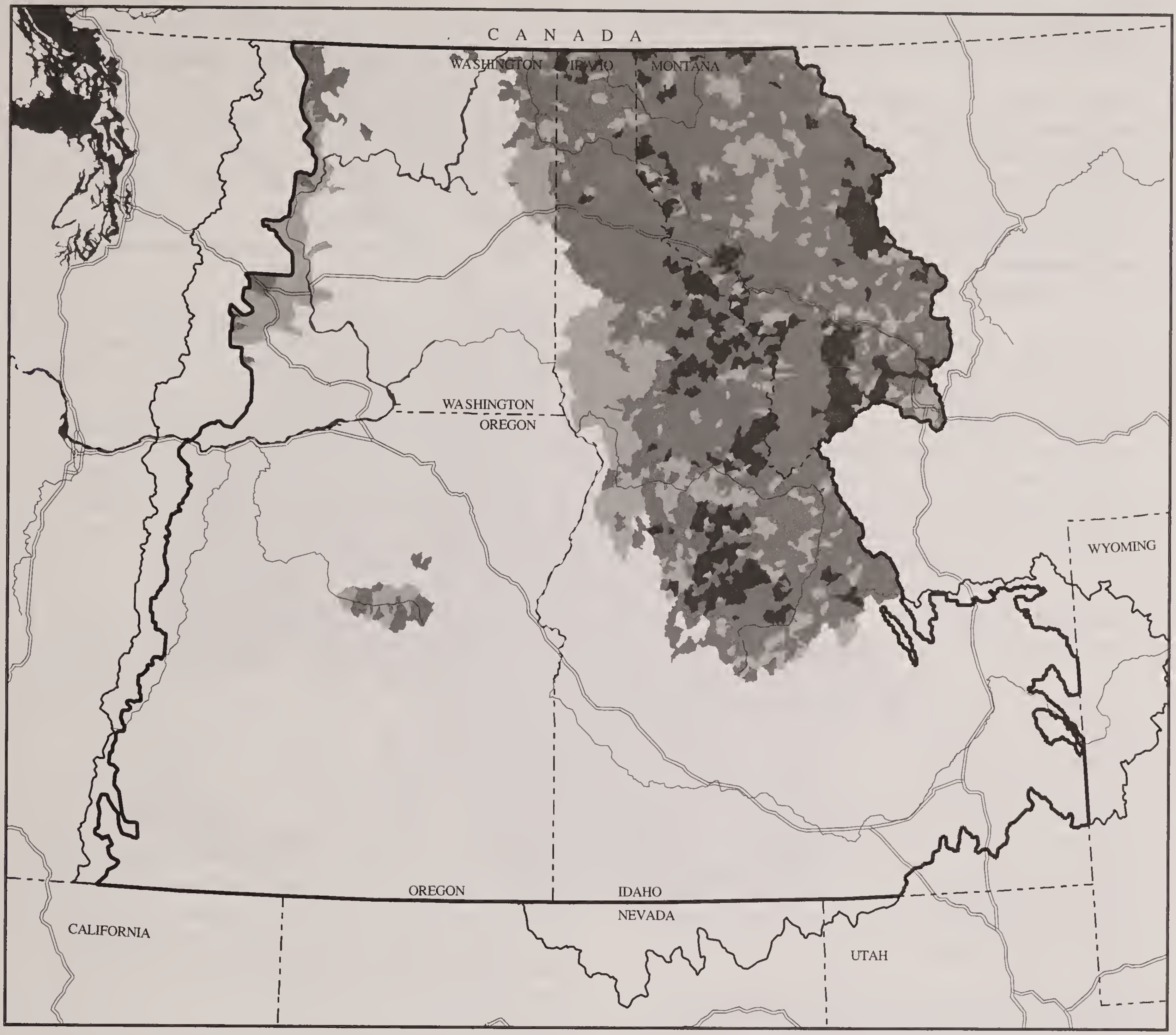

50 0 50 100 150 miles

50 0 50 100 150 km

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Map 2-18.
Westslope Cutthroat Trout Distribution: Historical and Current

Historical Range
Current Range
Known Strong Populations
Major Rivers
Major Roads
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restrictions have been implemented to improve or maintain most westslope cutthroat trout populations.

Most existing strong populations are largely in roadless and wilderness areas or national parks, suggesting that human disturbances have influenced distribution and abundance. In general, strong populations are thought to be primarily associated with areas of limited human influence and the associated potential effects of fishing, watershed disturbance, and non-native fish introductions.

Construction of dams, irrigation diversions, or other migration barriers have isolated or eliminated westslope cutthroat trout habitats that once were available to migratory populations. Resident forms may persist in isolated segments of streams, but the potential for long-term persistence is compromised by the loss of migratory life-history and lack of connectivity with other populations potentially important to gene flow or population dynamics.

Redband Trout ("Resident" and "Resident–Interior")

The redband trout (native rainbow trout) is a widely distributed western North America native salmonid. Of the key salmonids, redband trout originally had the widest distribution, occupying 73 percent of the watersheds within the project area. The only major portions of the project area that historically did not support redbands were the Snake River upstream from Shoshone Falls, tributaries to the Spokane River above Spokane Falls, and portions of the northern Great Basin in Oregon.

Redband trout within the project area have two distinct life histories, anadromous (steelhead) or non-anadromous (freshwater resident). For purposes of the *Scientific Assessment*, freshwater resident redbands were further divided into "resident–interior" (native non-anadromous redband trout outside the range of the steelhead) and "resident" (those populations that exist within the range of steelhead). Current and historical distributions of redband trout are illustrated on Map 2-19.

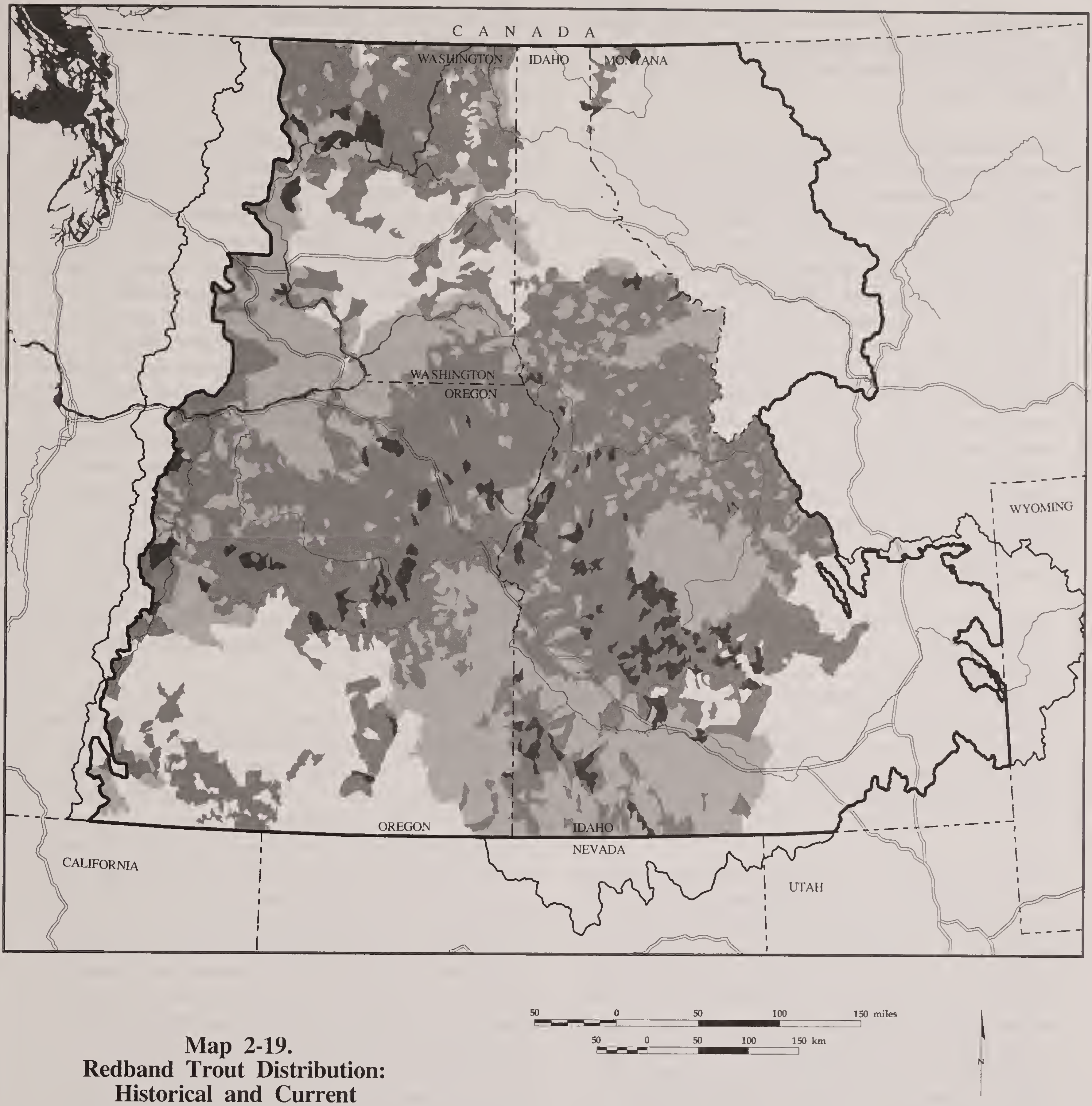
Resident and resident-interior redband trout are considered species of special concern by the American Fisheries Society and by all states within the project area. They are classified as a sensitive species by the Forest Service Pacific Northwest and Northern regions and the BLM. The Great Basin resident-interior population has been petitioned for listing under the Endangered Species Act and is currently under status review by the U.S. Fish and Wildlife Service.

Collectively, resident and resident-interior redband trout currently may be the most widely distributed key salmonid in the project area. However, despite their broad distribution, relatively few strong resident redband populations exist.

Less is known about the current distribution of redband trout than any of the other key salmonids. One reason for the lack of information is the inability to differentiate juvenile steelhead and resident redbands. Therefore the status of resident redbands was considered "unknown" when steelhead were present in a watershed. However, it is believed that collectively, resident and resident-interior redband trout currently may be the most widely distributed key salmonid in the project area.

The known and estimated distribution of both forms of non-anadromous redbands include 65 percent of the historical range. Resident redbands are the more widely distributed of the two forms; their known and estimated distribution includes 69 percent of the historical range. The largest areas of unoccupied historical habitat are in the Owyhee Uplands and Columbia Plateau ERUs. Resident-interior redbands are not as widely distributed and are currently found or estimated in 50 percent of the identified historical range. The distribution of native redband trout may be less than the above estimates indicate because of hybridization with stocked rainbow trout. Preliminary status reviews in Idaho, Oregon, and Montana generally support this concern.

Despite their broad distribution, relatively few strong resident redband populations exist. Known or predicted strong areas include 17 percent of the historical range and 24 percent of the present range. Only 30 percent of the watersheds supporting spawning and rearing populations were classified as having strong populations. Resident redbands are or are predicted to be widely distributed in large blocks of suitable habitat in the Northern Cascades, Blue Mountains, and Central Idaho Mountains ERUs. These watersheds represent the core of the distribution associated with or derived from steelhead and appear to be relatively secure, although hybridization with introduced rainbow trout is a unevaluated potential threat. Populations in watersheds within the Owyhee Uplands and Northern Glaciated Mountains were isolated from steelhead in recent history by dams. These latter populations appear to be far more fragmented and probably less secure. Because these



Map 2-19.
Redband Trout Distribution:
Historical and Current

Historical Range
Current Range
Known Strong Populations
Major Rivers
Major Roads
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latter populations are within the fringe of the range of redbands historically associated with steelhead, these populations may represent important sources of genetic diversity.

Resident–interior redband trout have few remaining strong populations; current strong populations encompass 10 percent of their historical range and 20 percent of their present range. Resident–interior redband trout occupy portions of the Northern Glaciated Mountains, Northern Great Basin, Columbia Plateau, Central Idaho Mountains, and Owyhee Uplands. These populations have been isolated from steelhead over geologic time. Resident–interior redband populations appear to have declined most in the Northern Great Basin and Columbia Plateau, where 72 percent of their historical range is presently unoccupied and there are few remaining strong populations. Remaining populations of redbands appear to be severely fragmented and restricted to small blocks of known or potential habitat. These areas likely represent a critical element of the evolutionary history for this species.

Interior redband habitats have been altered by a variety of land use practices. Reduction in streamflow because of water diversion for irrigation threatens many populations in the southern portion of the range. Increased water temperature also has been a factor, especially in drier and warmer areas. Temperature increases are largely due to loss or conversion of riparian vegetation resulting from grazing, timber harvest, urbanization, and agriculture.

There have been extensive channel alterations associated with flood-control projects, floodplain development, and road construction within the range of redbands. Channel alterations affect stream hydraulics, nutrient pathways, invertebrate production, and fish production. In Idaho, unaltered stream reaches supported eight to ten times the densities of redband trout observed in altered channels. Redband trout appear to have evolved over a broader range of environmental conditions than the other key salmonids, and appear to have less specific habitat requirements. Their apparent persistence even in some heavily disturbed basins suggests they are more resilient than other species. Therefore, the loss of a redband population could be a strong indication of disruption in the aquatic ecosystem processes.

Steelhead

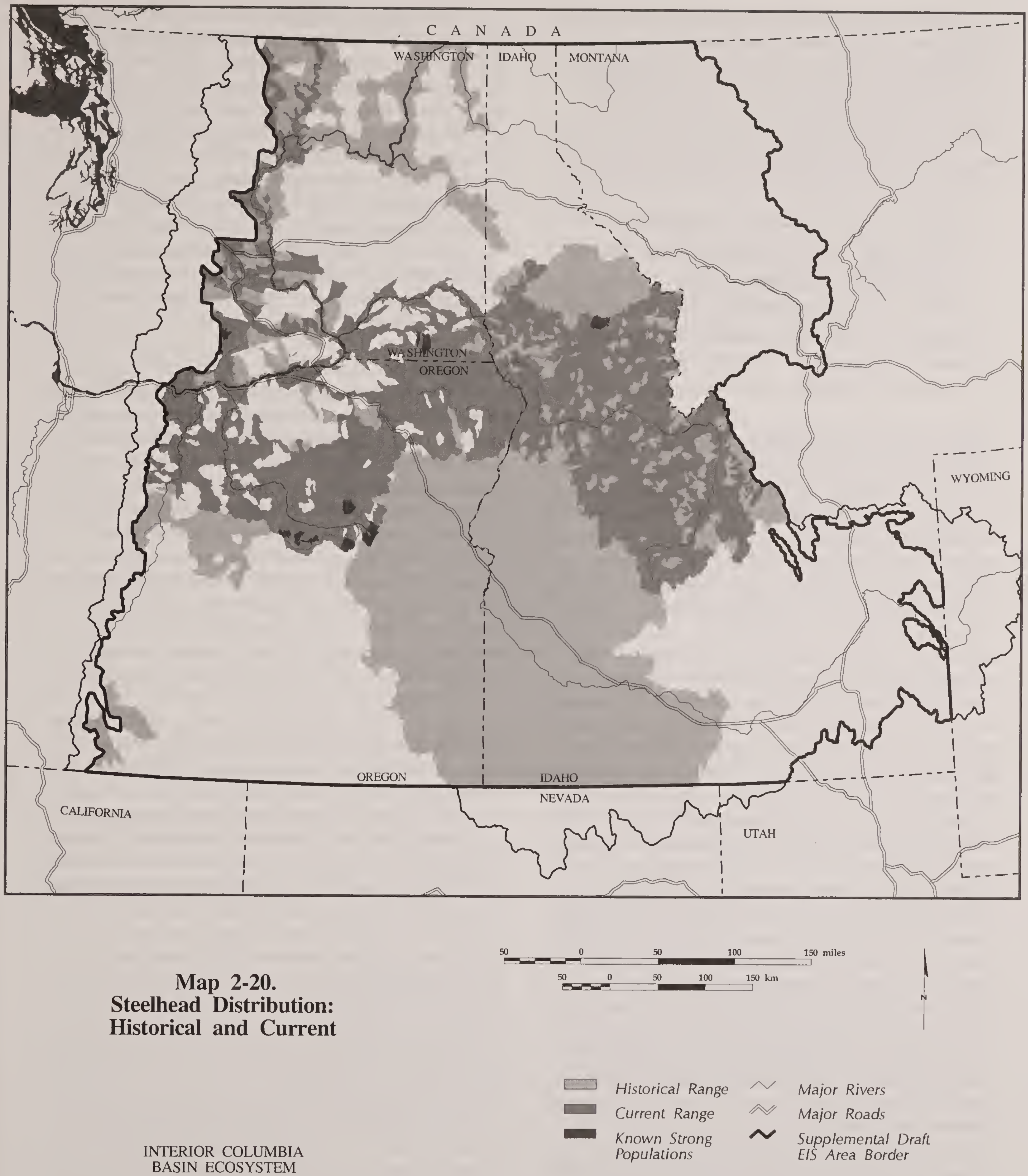
Steelhead, the anadromous form of redband trout found within the project area, are distributed within the interior Columbia River Basin as two major forms, winter and summer, although interior steelhead are primarily summer-run. Winter-run steelhead enter freshwater three to four months prior to spawning, and summer-run steelhead enter freshwater nine to ten months prior to spawning.

The distribution and abundance of steelhead have declined from historical levels as a result of mortality at and between dams, habitat degradation, loss of access to historical habitat, overharvest, and interactions with hatchery-reared and exotic fishes. Most of the current populations are hatchery-reared. Numerous state and federal management agencies list remaining wild steelhead populations as species of special concern. The American Fisheries Society considers all stocks of winter steelhead upstream from Bonneville Dam to be at high or moderate risk of extinction, and most summer steelhead stocks are considered to be at moderate risk of extinction or of special concern. Within the project area three steelhead stocks are listed under the Endangered Species Act: Snake River (threatened), Middle Columbia (threatened), and Upper Columbia (endangered). Steelhead represent a key species because of their broad distribution, value as a sport fish, and importance as a tribal ceremonial and subsistence resource. Current and historical distributions of steelhead are illustrated on Map 2-20.

The historical range of steelhead includes all freshwater west of the Rocky Mountains with access to the Pacific Ocean, extending from northwest Mexico to the Alaska Peninsula. Within the project area, steelhead were historically present in most streams that were accessible to anadromous fish, occupying about 50 percent of the watersheds in the project area. This included all accessible tributaries to the Snake River downstream from Shoshone and Spokane falls and accessible tributaries to the Columbia River. In total, approximately 10,500 miles of stream were accessible to steelhead in the Columbia River Basin (including Canada), although it is unlikely that steelhead occupied all reaches of all accessible streams because water temperature may have restricted distribution. Steelhead formerly ascended the Snake River and spawned in reaches of Salmon Falls Creek, Nevada, more than 900 miles from the ocean.

Historical steelhead runs were large. It is reported that the commercial steelhead catch peaked in the late 1890s at 4.9 million pounds. Initial estimates of run sizes were derived after Bonneville Dam was constructed in 1938. In 1940, 423,000 summer steelhead passed the dam. Annual sport harvests averaged 117,000 summer-run and 62,000 winter-run fish from 1962 to 1966.

Steelhead are still the most widely distributed anadromous salmonid in the project area; however, steelhead



Map 2-20. Steelhead Distribution: Historical and Current

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are extirpated from large portions of their historical range. Presently occupied watersheds encompass approximately 45 percent of the watersheds historically occupied. Steelhead have been extirpated in the Lower Clark Fork and Owyhee Uplands ERUs. Within the Columbia River Basin in the United States and Canada, about 75 percent of the stream mileage within their historical range is no longer accessible.

Within their current distribution, few healthy wild steelhead populations exist. Some 98 percent of the watersheds where steelhead spawn and rear are classified as containing depressed populations of wild steelhead.

Within their current distribution, few healthy wild steelhead populations exist. Watersheds known or estimated to support strong spawning and rearing populations of wild steelhead represent 0.6 percent of the historical range and 1.3 percent of the current range. Some 98 percent of the watersheds where steelhead spawn and rear are classified as containing depressed populations of wild steelhead.

Existing steelhead populations are composed of four main types: wild, natural (non-native progeny spawning naturally), hatchery, and mixes of natural and hatchery fish. Production of wild anadromous fish in the Columbia River Basin has declined by about 95 percent from historical levels. Most existing steelhead production is supported by hatchery and natural fish as a result of large-scale hatchery mitigation production programs. By the late 1960s, hatchery production surpassed wild production in the Columbia River Basin. Wild fish, unaltered by hatchery stocks, are rare and are present in only 10 percent of the historical range and 25 percent of the current distribution. Core areas for remaining wild stocks are concentrated in reaches of the Salmon River in Central Idaho and the John Day River Basin in Oregon. The only remaining strong populations are found among the wild stocks, primarily in the Columbia Plateau and Blue Mountains. Within the Central Idaho Mountains, recent steelhead runs have been critically low.

Construction and operation of mainstem dams on the Columbia and Snake rivers is considered a major cause of decline of steelhead. Hydroelectric development changed Columbia and Snake river migration corridors from mostly free-flowing in 1938 to a series of impoundments by 1975, and reservoir storage activities have reduced flows in most years during smolt migration. Steelhead must navigate past as many as eight mainstem dams. Adults are delayed during upstream migrations, and smolts may be killed by turbines; become disoriented or injured, making them more susceptible to predation; or become delayed in the large impoundments behind dams. Smolt-to-adult return rates declined from approximately 4 percent in 1968 to less than 1.5 percent from 1970 to 1974. In 1973 and 1977, low flows resulted in 95 percent mortality of migrating smolts. Since the initial operation of the hydrosystem several modifications, such as screen flow requirements, have been made in an attempt to improve migrant survival. Map 2-13 (earlier in this section) illustrates the locations of mainstem dams on the Columbia River System.

Non-native fish and hatchery operations have also affected wild steelhead populations. Hatcheries have been widely used in attempts to mitigate losses of steelhead caused by construction and operation of dams. Hatchery operations affect wild steelhead populations through genetic hybridization and loss of fitness, creation of mixed-stock fisheries, competition for food and space, and increased incidences of diseases. Introduced rainbow trout also have the potential to mature and hybridize with steelhead, and this species has been introduced throughout the current steelhead range. Supplementation of native stocks with hatchery fish have typically resulted in replacement, not enhancement, of native steelhead.

Biotic factors including predation and competition also may influence the abundance of steelhead. More than 55 exotic fish species have been introduced within the current range of steelhead. Because exotic fish species did not co-evolve with steelhead, there has been no opportunity for natural selection to lessen competition or predation. Dams have created habitat that is suitable for a variety of native (such as northern squawfish) and non-native predators and potential competitors. The abundance and distribution of native predators may also be influenced by human habitat alterations. More than 95 percent of healthy native anadromous fish stocks are believed to be threatened by some degree of habitat degradation. Fish habitat quality in most watersheds has declined. As described earlier in this chapter, pool frequency has decreased and fine sediment has increased in many project-area watersheds. In addition to hydroelectric development, most alterations of steelhead habitat can be attributed to land-disturbing activities as a result of mining, timber harvest, livestock grazing, agriculture, industrial development, and urbanization.

Chinook Salmon

Chinook salmon in the project area are traditionally described as spring, summer, and fall runs, distinguished primarily by their time of passage over

Bonneville Dam. These names have led to some confusion because stocks of similar run timing may differ considerably between the Snake and Columbia rivers in their spawning areas, life histories, behavior, and genetic characteristics. For the purposes of the Broadscale Assessment of Aquatic Species and Habitats (Lee et al. 1997), chinook salmon that migrate seaward as yearlings are called "stream-type" and those that migrate as subyearlings are called "ocean-type." Snake River chinook salmon (stream- and ocean- types; threatened) and Upper Columbia chinook salmon (stream-type; endangered) are listed under the Endangered Species Act. Current and historical distributions of chinook salmon are illustrated on Map 2-21.

The historical range of chinook salmon in North America was the eastern Pacific and Arctic oceans and accessible freshwater. Like steelhead, chinook salmon were found in all accessible areas of the Snake River downstream from Shoshone Falls, and they formerly ascended and spawned in reaches of Salmon Falls Creek, Nevada, more than 900 miles from the ocean. Approximately 10,500 miles of stream were accessible to chinook salmon in the Columbia River Basin in the United States and Canada.

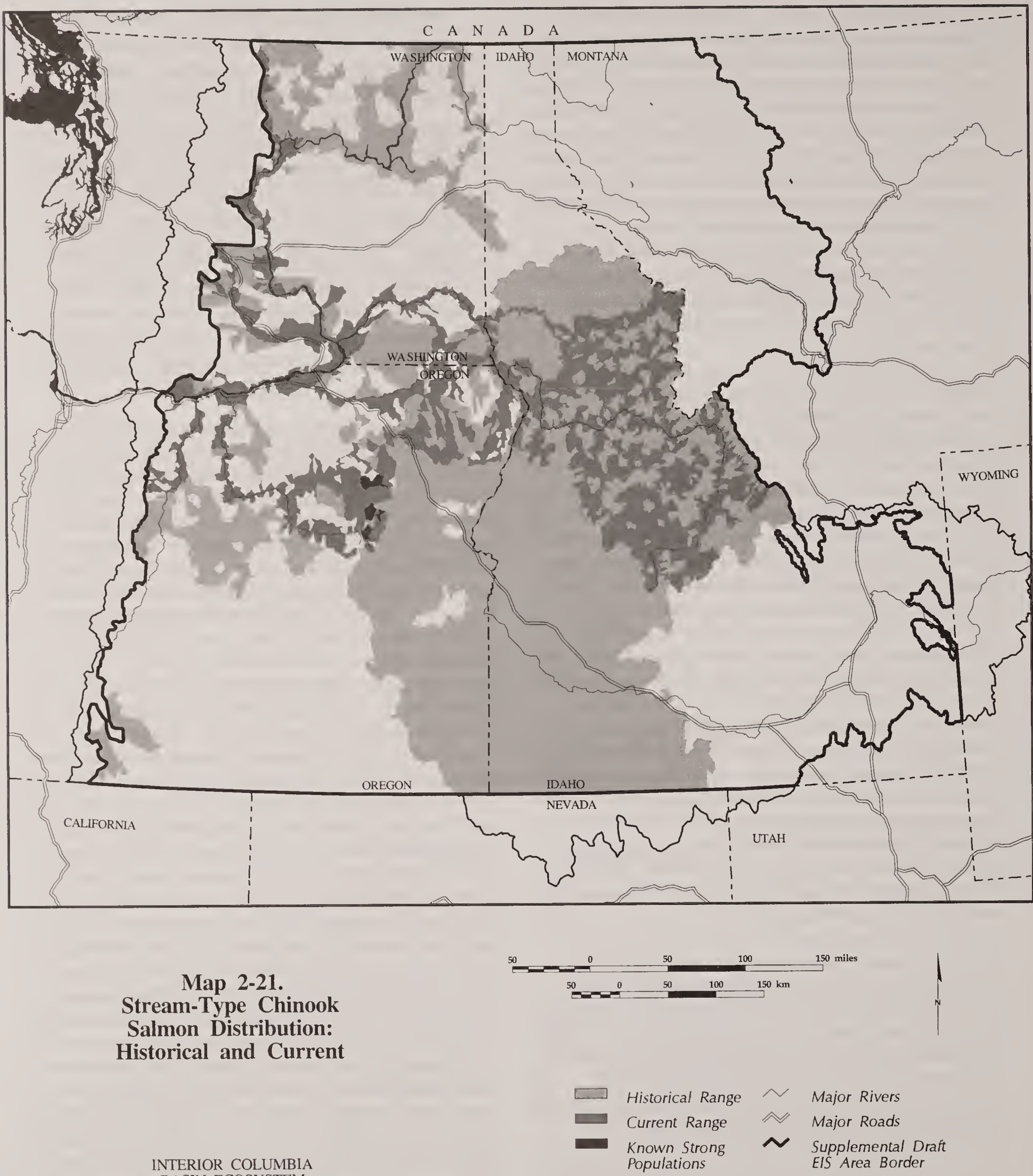
Stream-type chinook salmon were widely distributed, occupying about 45 percent of the watersheds in the project area, and occurring in all areas except the Northern Great Basin, Upper Clark Fork, Snake Headwaters, and Upper Snake above Shoshone Falls. Within accessible watersheds, chinook salmon distribution may have been restricted by unsuitable water temperatures at high elevations and the need for relatively large areas of suitable spawning gravel. Chinook salmon juveniles also prefer low gradient, meandering stream channels, which may have further restricted their distribution.

Historical runs of chinook salmon were immense; estimates of annual runs sizes prior to 1850 range from 3.4 to 6.4 million fish. Most American Indians in the project area shared a major dependence on salmon as a subsistence and ceremonial resource. Commercial harvest of chinook salmon in the mainstem Columbia River peaked in 1883 at 2.3 million fish, and the average annual yield was approximately 1.3 million fish from 1890 to 1920.

Chinook salmon are presently the most endangered of the key salmonids, with populations lost in large portions of their historical range. Construction of Grand Coulee Dam in the early 1940s and the Hells Canyon Dam complex in 1967 eliminated chinook salmon from much of their former ranges within the Upper Columbia and Snake river drainages. In total, about 75 percent of historically accessible streams are no longer accessible to chinook, primarily because of dam blockages. Current known and estimated distributions of stream-type chinook salmon include 28 percent of their historical ranges. Stream-type chinook are extirpated in all of the Lower Clark Fork and Owyhee Uplands and in large portions of other ecological reporting units that currently support populations. In the Snake River, an estimated 1,882 naturally produced stream-type chinook salmon reached Lower Granite Dam in 1994 as compared to an estimated production of 1.5 million fish in the late 1880s.

About 75 percent of historically accessible streams are no longer accessible to chinook

Most chinook salmon stocks in the remaining accessible range are severely depressed and at risk. For stream-type chinook salmon, watersheds known or estimated to support strong spawning and rearing populations represent 0.2 percent of the historical range and 0.8 percent of the current range; approximately 99 percent of the current stream-type chinook spawning and rearing populations are classified as depressed. The only remaining strong populations appear to be restricted to small areas of the John Day River Basin in the Blue Mountains. Within the Central Idaho Mountains, recent runs of stream-type chinook salmon have been critically low, and most populations are believed to be on the brink of extinction. Construction and operation of mainstem dams on the Columbia, Snake, and Klamath rivers is considered a cause of decline of chinook salmon (Map 2-13, earlier in this section). Besides reducing accessible habitat, hydroelectric development changed Columbia and Snake river migration corridors from mostly free-flowing in 1938 to a series of impoundments by 1975, and reservoir storage activities have reduced flows in most years during smolt migration. Like steelhead, chinook adults are delayed during upstream migrations, and smolts may be killed by turbines; become disoriented or injured, making them more susceptible to predation; or become delayed in the large impoundments behind dams. Development and operation of hydropower facilities in the Columbia River Basin has reduced salmon and steelhead production by about eight million fish: four million from blocked access to habitat above Chief Joseph and Hells Canyon dams, and four million from ongoing passage losses at other facilities. Passage losses are cumulative depending on the number of dams; chinook salmon in the project area must pass one to nine dams. Losses of mid and upper Columbia ocean-type chinook salmon were estimated to be approximately 5 percent per dam for adults and 18 to 23 percent per dam for juveniles.



Map 2-21. Stream-Type Chinook Salmon Distribution: Historical and Current

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Like steelhead, many remaining chinook salmon populations have been influenced by hatchery-reared fish. Production of wild anadromous fish in the Columbia River Basin has declined by approximately 95 percent from historical levels. As a result, wild populations unaltered by hatchery stocks are rare; they are present in 4 percent of the historical range and 15 percent of the current range of stream-type chinook salmon. Only those watersheds in the project area containing spawning and rearing populations sustained by wild stocks are classified as strong.

The overall pattern of decline of chinook salmon suggests the species is sensitive to habitat degradation throughout its entire range. Excessive livestock grazing pressure, timber harvest, and irrigation diversions have been important factors. Reduced stream habitat diversity has been one of the most pervasive cumulative effects of forest management practices and may have altered fish communities. Forest management practices, including timber harvest activities, have reduced salmon habitat quantity and diversity, reduced habitat complexity, increased sedimentation, and eliminated sources of woody debris needed for healthy salmon habitat. In the Snake River Basin, more than 80 percent of the salmon production occurs on Forest Service- and BLM-administered lands. In portions of the Snake River Basin still accessible to salmon, management history on Forest Service-administered lands has reduced the suitability of approximately 1,930 miles of stream.

Predation is one of the major causes of mortality to juvenile chinook salmon. Exotic species may prey upon and compete with native fishes. Many of the middle and lower reaches of the Columbia River are dominated by exotic fish species. Northern squawfish, a native predator, has become well adapted to the habitat created by dams. It has been estimated that 15 to 20 million juvenile salmonids in the Snake and lower Columbia rivers are lost to northern squawfish predation.

Native Species Richness, and Biotic and Genetic Integrity

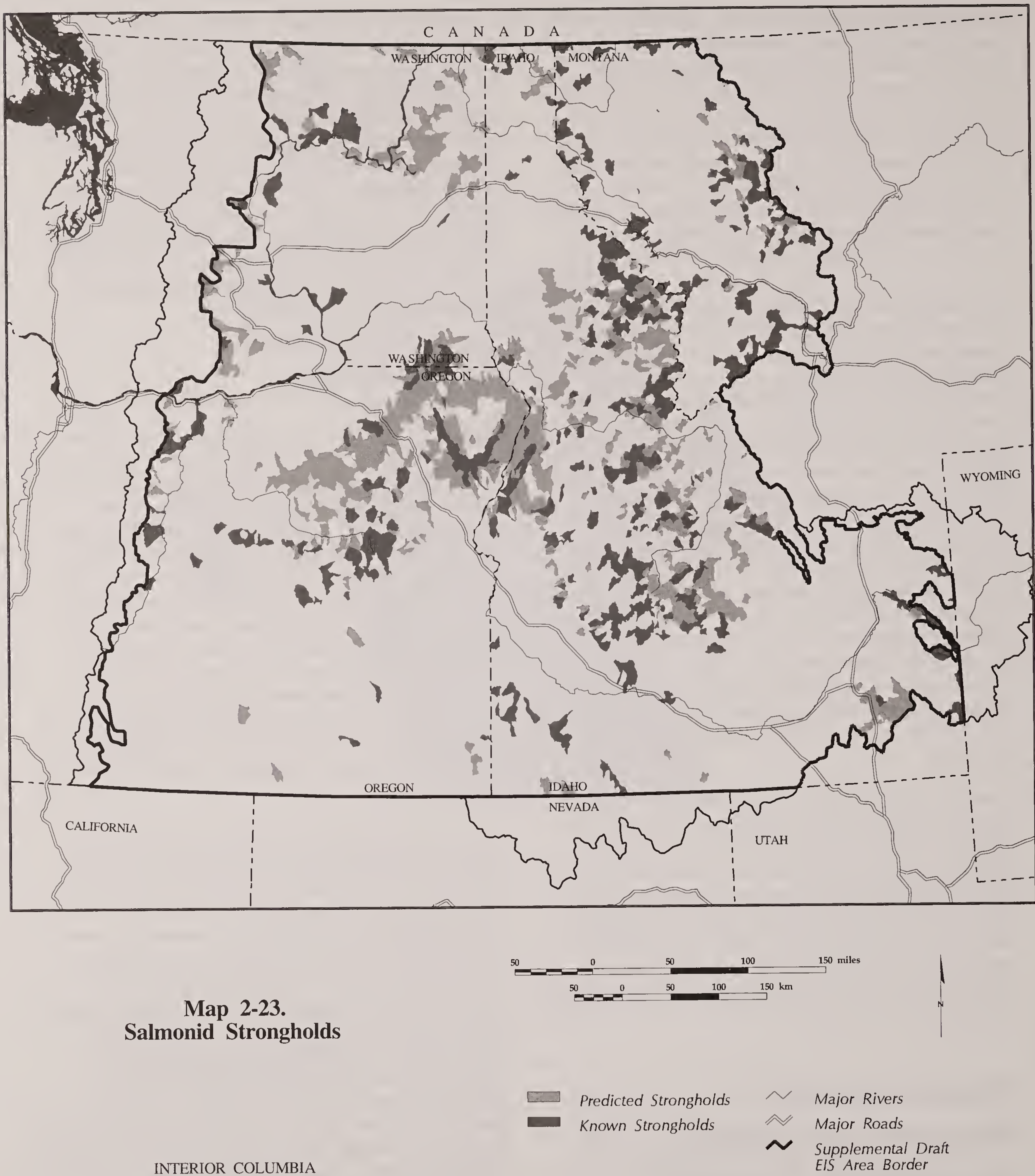
The information presented in this section was used to determine the A1/A2 subwatershed boundaries and aquatic restoration priorities described in Chapter 3.

The specific conditions regarding fish species and groups of fishes that are outlined in preceding sections can be integrated in various ways to provide an overall picture of aquatic conditions in the project area. Some key attributes include native species richness (number of species), and genetic and biological integrity. This information can help prioritize management actions through watershed categorization or designation of important watersheds. Key (or priority) watersheds have been identified under various Biological Opinions for federally listed fish species and other native fish recovery plans. For the Draft EISs, the Science Integration Team developed subbasin categories that summarize current aquatic conditions, especially with regard to management opportunities and priorities.

Species Richness

The number of native fish species (species richness) present in a watershed is an important element of biodiversity. A high degree of overlap in species are characteristic of strong habitat diversity. Even considering a fairly narrow group of species such as the salmonids, each species relies on different habitats and environments. The occurrence of several salmonids indicates suitable habitats over relatively large landscapes. High richness may also indicate critical habitats that serve as common corridors, wintering areas, or seasonal refuges for varied life histories. The largest remaining regions of high species overlap considering all native fish species are associated with the Central Idaho Mountains, Blue Mountains, Northern Cascades, and their connecting river corridors.

Overlap of strong populations for multiple native salmonids indicates areas of high species richness that have not yet experienced extensive declines in fish populations. Presently within the project area, less than 0.01 percent of the subwatersheds concurrently support three strong salmonid populations, 3 percent support two strong populations, and approximately 20 percent support one strong population. The largest block of contiguous or clustered subwatersheds supporting strong populations is within subbasins in the Central Idaho Mountains, Blue Mountains, and Snake Headwaters ERUs. Smaller blocks are found in the Upper Clark Fork and the extreme eastern fringe of the Northern Glaciated Mountains ERUs. Most of the watersheds supporting strong populations are found on Forest Service-administered lands (75 percent), and some (29 percent) are located within protected areas represented by designated wilderness areas or national parks. Subwatersheds with multiple strong populations are more commonly under Forest Service management than other ownerships. Map 2-23 illustrates the current known and estimated key salmonid strongholds in the project area.



Map 2-23.
Salmonid Strongholds

INTERIOR COLUMBIA
BASIN ECOSYSTEM
MANAGEMENT PROJECT

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Biotic Integrity

The concept of biotic integrity has been proposed to evaluate the loss of natural diversity and to define those remaining portions of the landscape that could be most valuable in maintaining or closely approximating historical levels of natural diversity. Biotic integrity has been generally defined as "the ability to support and maintain a balanced, integrated, adaptive community of organisms having a species composition, diversity, and functional organization comparable to that of the natural habitat of the region" (Karr and Dudley 1991 as cited in Lee et al. 1997). Integrity specifically refers to native biota that reflect natural evolutionary and biogeographic processes. Several measures of biotic integrity have been developed, often reflecting different attributes for communities of invertebrates and amphibians as well as fish (Fisher 1989; Lyons et al. 1995 as cited in Lee et al. 1997).

Because project-wide information was limited to fish in the *Scientific Assessment*, a relatively simple measure of integrity was developed reflecting the diversity and structure of the native fish community at both the life-history and species levels of organization (Lee et al. 1997). The highest concentration of high integrity values was found in the Northern and Southern Cascades, Blue Mountains, Central Idaho Mountains, and the southern edge of the Columbia Plateau. Smaller blocks of high values were also found in the Lower Clark Fork. One readily apparent trend is that many of the high-value integrity areas are found in forested areas within the range of anadromous fish. Rangeland and agricultural areas tended to have lower integrity values.

Genetic Integrity

Hatchery programs may erode genetic diversity and alter certain gene complexes that evolved together and are characteristic of locally adapted stocks of salmonids. The effects may include a loss of fitness or performance (growth, survival, and reproduction) and a loss of genetic variability important to long-term stability and adaptation in varying environments. The analysis of genetic integrity is incomplete and would require a finer level of analysis for a consistent application to resident salmonids, but in general the areas important to the genetic integrity of the anadromous salmonids are found principally within the Blue Mountains and Central Idaho Mountains ERUs, where hatchery fish have had little or no influence on current populations.

Fringe Environments

'Fringe' environments are those at the extreme edges of a species distribution. Fringes may support a disproportionately large part of the genetic diversity within a species because of the genetic adaption needed to survive in a variable environment. Populations that represent native gene complexes and the widest possible diversity probably offer the best resources for reestablishing extinct populations in similar environments. They are also important for sustaining the most important components of overall genetic diversity characteristic of these species.

The fringe of the range for westslope cutthroat trout is in the Blue Mountains. Watersheds within the Columbia Plateau technically qualify as part of the westslope cutthroat fringe distribution, but those watersheds are really part of a much larger distribution of cutthroat in the upper portions of that basin. For that reason the Columbia Plateau was not included as part of the fringe for westslope cutthroat trout. The fringe defined for bull trout includes the Southern Cascades, the Upper Klamath, the Owyhee Uplands, and the Walla Walla and Umatilla drainages within the Columbia Plateau.

The Upper Klamath, Northern Cascades, and Owyhee Uplands are recognized as fringe areas in the remaining distribution of resident-interior redband trout. No watersheds are considered to represent a fringe for Yellowstone cutthroat trout or resident redband trout. Any further loss of current distributions within the Upper Snake or Upper Klamath Basin would make these areas of concern, however. The Northern Glaciated Mountains was identified in the *Scientific Assessment* as the fringe for steelhead. Population declines within the Southern Cascades could make that area important for steelhead as well. The Southern Cascades and Northern Glaciated Mountains are important for stream-type chinook salmon. The distribution of ocean-type chinook salmon within the project area is so restricted that all of the remaining distribution qualifies as part of the fringe.

Subbasin Categories

The subbasin categories were used in the development of aquatic restoration priorities. To assist with an ecosystem approach to the management of watersheds and aquatic resources, the Science Integration Team developed a simple classification of subbasins

The Effects of Hydropower, Hatcheries, Harvest, and Habitat on Interior Columbia River Anadromous Fishes

Anadromous fishes are the focus of this sidebar because of their current scarcity resulting from influences of hydropower, hatcheries, harvest, and habitat. These four activities, which affect or limit the survival of anadromous fishes, have been broadly grouped as the *ALL Hs* (*Idaho Department of Fish and Game et al. vs. NMFS et al.*1994). Because of the cumulative effect of the *ALL Hs,* several salmon and steelhead stocks within the project area have been listed as endangered or threatened pursuant to the Endangered Species Act (ESA).

In public scoping and comments on the ICBEMP Draft EISs, an important question surfaced about how hydropower, harvest, and hatcheries (factors outside the land management agencies' jurisdictions), would be considered in the development of alternative Forest Service and BLM land management strategies that affect anadromous fish habitat. The Executive Steering Committee for the ICBEMP directed that the project specifically address the following:

1. What are the relative contributions of habitat, hydropower, hatcheries, and harvest on the current state of populations within the interior Columbia River Basin?
2. If all other factors were held constant, would a further degradation of habitat increase the risks of extirpation or extinction?
3. If all other factors were held constant, would an improvement in freshwater habitat conditions increase fish abundance and reduce the risks of extirpation or extinction?
4. If nothing is done to restore habitat, and if mitigation of major factors such as dams is successful, would there be sufficient habitat available to accommodate increasing fish numbers?

Forest Service- and BLM-administered habitat for anadromous fish is also important for numerous other aquatic and riparian resources and human uses, including: native trout, amphibians, recreation, and clean water. Alternative land management strategies will consider these important resource values in addition to the anadromous fish issues discussed below.

This summary, based on a Science Integration Team report (Lee and Rieman 1996) and other relevant sources cited in the text, responds to the above four questions. It provides an overview of the effects of habitat, harvest, hydropower and hatcheries on interior Columbia River Basin anadromous fishes. It does not apply to resident native fish such as bull trout and cutthroat trout, which do not migrate to and from the ocean. The information is generally applicable to spring/summer and fall chinook, sockeye, and steelhead in the interior Columbia River Basin.

1. What are the relative contributions of habitat, hydropower, hatcheries, and harvest on the current state of populations within the interior Columbia River Basin?

Hydroelectric development is generally regarded as a major factor in the decline of anadromous populations, irrespective of changes in freshwater habitat (Northwest Power Planning Council 1986, in Lee and Rieman 1996; Raymond 1988, in Lee and Rieman 1996). Explicit recognition of the role of hydroelectric development contributed to passage of the Northwest Power Planning and Conservation Act of 1980, and to development of the Northwest Power Planning Council's Fish and Wildlife Program, a regional effort to simultaneously address the four principal factors affecting anadromous fish.

Habitat is a major factor in supporting anadromous fish populations. The information provided by the broad-scale assessment of aquatic habitats and species within the interior Columbia River Basin (Lee et al. 1997) lends support to a scientifically credible view that is emphasized repeatedly in the literature: habitat change is pervasive and at times dramatic, but impacts are not evenly distributed across the landscape. For instance, there are remaining high-quality areas, generally associated with wilderness or other protected areas, that are capable of supporting anadromous fishes at near historical levels in these areas. In many other areas habitat has been degraded and survival of the freshwater life stages has been compromised. To support recovery of populations of anadromous fish, it will be

necessary to expand and reconnect areas of high quality habitat. Restoration of depressed populations cannot rely on habitat improvement alone, but requires a concerted effort to address causes of mortality in all life stages. These include freshwater spawning, rearing, juvenile migration, ocean survival, and adult migration.

The question of relative contributions of the *ALL Hs* to anadromous fish mortality cannot be answered precisely. Simultaneous changes in a variety of factors, combined with the lack of historical data, prevents estimation of the proportionate influence of each factor across the entire basin. It is expected that the contribution of freshwater habitat changes to declines in anadromous fish populations is least in the less disturbed areas of central Idaho (such as in wildernesses or other protected areas), where there are the most dams between spawning and rearing areas and the ocean, and in the northern Cascades, but greater in the lower Snake and mid-Columbia drainages. Similarly, the contribution of hydropower to fish mortality declines downriver where there are fewer dams between freshwater spawning and rearing areas and the ocean (Lee et al. 1997). Hatcheries are an important element throughout the basin, but their effects on native stocks are quite variable. Harvest, which has been curtailed in recent years, has less of an effect today than it did historically. In some subbasins such as the Umatilla, irrigation withdrawals may be the major contributor to declines in naturally reproducing populations.

2. **If all other factors were held constant, would a further degradation of habitat increase the risks of extirpation or extinction?**

Yes, regardless of the contributions of other factors, spawning and juvenile rearing habitat remain an important component in the viability equation. Freshwater habitat can be most important in ensuring viability of stocks that are depressed through a combination of other factors.

3. **If all other factors were held constant, would an improvement in freshwater habitat conditions increase fish abundance and reduce the risks of extirpation or extinction?**

Yes, although the magnitude of the effect would vary greatly from subbasin to subbasin. In areas where present habitat is degraded and hydropower effects are smaller, such as the John Day and Deschutes rivers, habitat improvements could result in immediate increases in numbers of fish. In areas where habitat is degraded and hydropower effects are large, such as in the Grand Ronde River and some tributaries of the Salmon River (for example, Panther Creek), increases in population numbers due to habitat restoration would be more modest and gradual. In other areas where there is abundant high-quality habitat but few adult spawners, such as in the Middle Fork Salmon River, immediate increases in fish abundance would not be expected. One aspect of habitat improvement that could have long-term repercussions, if not immediate benefits, is that increased availability of high-quality habitats reduces the chances that a random, catastrophic event such as a large fire followed by flooding would wipe out all of the best available habitat. A wider distribution of high-quality habitats also improves the likelihood of increased genetic diversity, an additional benefit over the long term. In general, while additional high quality habitat alone could increase the abundance of individual fish, it would not likely reverse current negative population trends in the short term.

4. **If nothing is done to restore habitat, and if mitigation of major factors such as dams is successful, would there be sufficient habitat available to accommodate increasing fish numbers?**

The answer varies across the basin. Population numbers in much of the interior Columbia River Basin are far below what current habitat conditions could likely support under a scenario of increased downriver survival. Some remote areas (for example central Idaho and northern Cascades) potentially could support hundred-fold increases or better in the number of adult fish, but this is not the case everywhere. There are disturbed areas where increased adult numbers would lead to compensatory declines in freshwater survival rates, thus reducing the per capita productivity of the population and limiting the effectiveness of downstream improvement efforts. If the objective is to fully realize the benefits of downstream improvements, then commensurate increases over current availability and distribution of high-quality habitat will be necessary.

throughout the Interior Columbia Basin Ecosystem Management Project area (Lee et al. 1997). Subbasins were used as the primary classification unit because they commonly approximate complete aquatic ecosystems, supporting most of the life-history diversity expected over larger river basins (see the Introduction to this chapter for an explanation of subbasins and 4th-field Hydrologic Unit Codes). Three broad categories of subbasin condition (as it relates to aquatic ecosystems) have been defined, recognizing that a continuum of conditions exists. Subbasins were categorized along a gradient of conditions relative to highly functional aquatic ecosystems. Highly functional systems were defined as subbasins with a full complement of native fishes and other aquatic species, and well distributed and connected high quality habitats. The classification is based on the integration of current data as well as local knowledge of watershed connectivity and condition that is not expressed quantitatively. Subbasin categories developed by the Science Integration Team are illustrated in Lee et al. 1997, Map 4.74, and in the ICBEMP Draft EISs, Map 2-25 (UCRB) or Map 2-36 (Eastside).

The categorization is intended to set the stage for a broad-scale analysis of management needs and opportunities that can focus the need for finer-scale analysis. It is intended to facilitate the discussion of management opportunity and conflict by providing a description of aquatic issues and needs that could be associated with similar descriptions for terrestrial ecosystems. It is not intended to be all inclusive, final, or inflexible.

Category 1 Subbasins

Category 1 subbasins most closely resemble natural, fully functioning aquatic ecosystems. In general they support large, often continuous blocks of high-quality habitat and watersheds with strong populations of multiple species. Connectivity is unimpeded among watersheds and through the mainstream river corridor. All life histories, including migratory forms, are present and important. Native species predominate, although introduced species may be present. These subbasins provide a system of large, well-dispersed habitats that are resilient to large-scale disturbances. They provide the best opportunity for long-term persistence of native aquatic assemblages and may be important sources of individuals that could recolonize other areas.

Category 2 Subbasins

Category 2 subbasins support important aquatic resources and often have subwatersheds classified as strongholds for one or more species scattered throughout. The integrity of the fish assemblage is high or moderate. The most important difference between Category 1 and Category 2 subbasins is increased fragmentation in Category 2 that has resulted from habitat disruption or loss. These subbasins have numerous watersheds where native species have been lost or are at risk. Connectivity among watersheds exists through the mainstream river system, or has the potential for restoration of life-history patterns and dispersal among watersheds. Because these subbasins commonly fall in some of the more intensively managed landscapes, they may have extensive road networks. Stronghold subwatersheds are scattered rather than contiguous. These subbasins are more likely to have aquatic and hydrologic restoration opportunities through active manipulation, or through attempts to produce more episodic disturbance followed by long periods of recovery.

Category 3 Subbasins

Category 3 subbasins may support populations of key salmonids or have other important aquatic values, such as threatened or endangered species, narrow endemics, and/or introduced or hatchery-supported sport fisheries. In general, however, these watersheds are strongly fragmented by extensive habitat loss or disruption throughout the component watersheds, and most notably through disruption of the mainstream corridor. Major portions of these subbasins are often associated with private and agricultural lands not managed by the Forest Service or BLM. Although important and unique aquatic resources exist, they are usually localized. Opportunities for restoring connectivity among watersheds, full expression of life histories, or other large-scale characteristics of fully functioning and resilient aquatic ecosystems are limited or nonexistent in the near future. Because the remaining aquatic resources are often strongly isolated, risks of local extinction may be high. Conservation of the remaining productive areas may require a disproportionate contribution from federal management agencies, because these subbasins often include large areas of non-federal land.

Social-Economic-Tribal Component

Key Terms Used in This Section

Amenity — Resource use, object, feature, quality, or experience that is pleasing to the mind or senses; typically refers to values for which monetary values are not or cannot be established, such as scenic or wilderness values.

Animal Unit Month (AUM) — The amount of feed or forage required by one animal-unit grazing on a pasture for one month. An animal-unit is one mature cow plus calf, or one horse, or five domestic sheep.

Band — A group of people who share a culture, territory, and sense of mutual recognition. Bands are primarily those American Indian groups from the pre-treaty-making period.

Beneficiary — The recipient for whose benefit property is held in trust.

Ceded lands — Lands that tribes ceded to the United States by treaty in exchange for reservation of specific land and resource rights, annuities, and other promises in the treaties.

Commodity — Commercial article that can be bought, sold, and transported, such as mining, agricultural, timber, or other forest products.

Community (human) — A group of people residing in the same place and under the same government: especially defined places such as towns. A "community of interest" refers to people who share a common concern but may not be located in the same place.

Consultation — (1) An active, affirmative process which (a) identifies issues and seeks input from appropriate American Indian governments, community groups, and individuals; and (b) considers their interests as a necessary and integral part of the BLM and Forest Service decision-making process. (2) The federal government has a legal obligation to consult with American Indian tribes. This legal obligation is based in such laws as Native American Graves Protection and Repatriation Act, American Indian Religious Freedom Act, and numerous other executive orders and statutes. This legal responsibility is, through consultation, to consider Indian interests and account for those interests in the decision. (3) Consultation also refers to a separate requirement under Section 7 of the Endangered Species Act for federal agencies to consult with the U.S. Fish and Wildlife Service and/or National Marine Fisheries Service with regard to federal actions that may affect listed threatened or endangered species or critical habitat.

Economically Specialized Community — A community whose employment in one or more industry groups (for example, agriculture, mining, construction, or manufacturing), as a percentage of total community employment, is greater than the same percentage for the economic subregion in which the community is located. For instance, if the jobs in a particular industry group in the economic subregion make up 5 percent of total employment, but the jobs in the local community in that industry account for 10 percent of total community employment, the community would be considered economically specialized in that industry.

In-migration — The movement of new residents into an area.

Isolated Community — A community located more than 35 to 50 miles from any town with a population greater than 9,000. Communities with populations between about 1,900 and 9,000 are referred to as "isolated trade centers."

Lifeways — The manner and means by which a group of people lives; their way of life. Components include language(s), subsistence strategies, religion, economic structure, physical mannerisms, and shared attitudes.

Out-migration — The movement of former residents away from an area.

RAC/PAC — Resource Advisory Councils (RACs) were established by the BLM to provide a forum for non-federal partners to engage in discussion with BLM managers regarding management of federal lands. Provincial Advisory Committees (PACs) were established by the Forest Service, under the Northwest Forest Plan, to provide a forum for non-federal groups and individuals to advise and make recommendations to federal land managers regarding management of federal lands. There are 12 RAC or PAC areas in the project area. Each area has its own advisory council or committee.

Recreation Visit — A visit by one individual to a recreation area for the purpose of participating in one or more recreation activities for any length of time. (Only the primary activity for the visitor is recorded.)

Resiliency (human community) — The ability of a community to adapt to externally induced changes such as larger economic and social forces.

Tribe— Term used to designate any Indian tribe, band, nation, or other organized group or community, including any Alaska Native village or regional or village corporation as defined in or established pursuant to the Alaska Native Claims Settlement Act, which is recognized as eligible for the special programs and services provided by the United States to Indians because of their status as Indians.

Trustee — One that holds property for the benefit of another.

Summary of Conditions and Trends

Social and Economic Considerations

- The project area is sparsely populated and rural, especially in areas with a large amount of federal lands. Some areas are experiencing rapid population growth, especially those areas offering high quality recreation and scenery. Population growth can stimulate economic growth and provide new economic opportunities, which may promote economic diversification.
- Development for a growing human population is encroaching on previously undeveloped areas adjacent to lands administered by the Forest Service or BLM. Population growth and associated new development can put stress on the political and physical infrastructure of rural communities, diminish habitat for wildlife, and increase agency costs to manage fire to protect people and structures.
- The factors that appear important in making communities resilient to economic and social change include population size and growth rate, economic diversity, social and cultural attributes, amenity setting, and quality of life. The ability of agencies to contribute to the maintenance or improvement of community resiliency depends in part on how well federal land uses and management strategies influence these factors in a positive way.
- Agency social and economic policy has historically emphasized the goal of supporting rural and tribal communities, specifically promoting continued production of goods and services from adjacent federal lands for those communities deemed dependent on federal timber harvest and processing and livestock forage.
- Predictability in timber sale volume from federal lands has been increasingly difficult to achieve. Advancing knowledge about the landscape-scale effects of timber harvest, changing societal goals that emphasize habitat protection over commodity production, and changing forest health conditions have challenged traditional assumptions about availability of timber sale volume from federal lands.
- Changing levels and values of commodity outputs can affect budgets of counties that have benefitted from federal sharing of receipts from sales of commodities and services on BLM- and Forest Service-administered lands.
- Recreation is an important use of federal lands in the project area in terms of economic value and amount of use. Most recreation use is tied to roads and accessible water bodies, although primitive and semi-primitive recreation is important as well.
- The public has invested substantial land and capital in building road systems on federal lands in the project area, primarily to serve commodity uses. On National Forest System lands, commercial timber harvest has financed 90 percent of the construction cost and 70 percent of the maintenance cost. Recreation now accounts for 60 percent of the use. Decreasing trends in timber harvesting and new road management objectives make the cost of managing and maintaining these road systems a key issue.
- At the local level, some communities rely on economic activity supported by harvest and processing of forest products, livestock grazing, mining, and recreation. Forest products and livestock grazing no longer solely dictate the economic prosperity of the region, even though they remain economically and culturally important in rural areas. The economic dependence of communities on these industries is highest in areas that are geographically isolated and offer few alternative employment opportunities.

Federal Trust Responsibility and Tribal Rights and Interests

- The relationship that American Indians have with federal lands may be affected by proposed actions on forestlands and rangelands because of changes in vegetation structure, composition, and density; existing roads; and watershed conditions.
- Culturally significant species such as anadromous fish and the habitat necessary to support healthy, sustainable, and harvestable aquatic and terrestrial species constitute a major, but not the only, American Indian relationship potentially affected by the ICBEMP decision, along with other factors that keep the ecosystem healthy.
- Indian tribes have low confidence and trust that their rights and interests are considered when decisions are proposed and made for actions to be taken on BLM- or Forest Service -administered lands.
- Indian tribes feel that they are not included in the decision-making process commensurate with their legal status, and that government-to-government consultation is not taking place.

Social and Economic Considerations

Introduction

This section describes current social and economic conditions and trends in the interior Columbia River Basin, the upper Klamath River Basin, and the upper portion of the northern Great Basin. The project area includes 92 counties in parts of four states, with more than 510 communities—cities, towns, villages, and other unincorporated places. There are 471 communities in the project area whose population is tracked by the U.S. Census. The project area is the heart of what was known in the early 1800s as the Oregon Country. For an historical overview of human uses of these lands, see the Introduction to Chapter 2, the Humans and Land Management/Snapshots in Time section, and the *Assessment of Ecosystem Components*, Vol. IV (Quigley and Arbelbide 1997).

The relationship of social, economic, and political systems to Forest Service- and BLM-administered lands in the project area is described to establish the context for making land use choices, while considering human needs and expectations for these lands.

A description of population characteristics is followed by an overview of how resources associated with Forest Service- or BLM-administered (federal) lands in the project area have been used to meet the social and economic needs of people. Employment generated by federal land uses is then described at both the project area level and by Resource Advisory Council/ Provincial Advisory Committee (RAC/PAC) area. Attributes of counties are displayed to help describe the interrelationships of counties and their local communities with federal lands. The discussion then turns to communities, with special attention given to community population, isolation, and economic specialization; socio-economic resiliency; and quality of life. Particular challenges for tribal reservations and communities are mentioned. Finally, an overview of public attitudes, beliefs, and values regarding the use of federal lands is given, including a discussion of attachments that people feel for special places, and the role of "place" in tribal culture, traditions, and religion.

The broad-scale level of analysis and estimation of effects, as well as data limitations, make it impossible to provide specific effects for each community in this planning process.

Much of the material in this section was derived from the *Assessment of Ecosystem Components in the Interior Columbia Basin and Portions of the Klamath and Great Basins* (Quigley and Arbelbide 1997), including the *Economic Assessment of the Basin* (Haynes and Horne 1997) and *Social Assessment* (McCool et al. 1997). Other sources are referenced as needed. In this section, "agencies" refers to the Forest Service and BLM, and "federal lands" refers to lands administered by the Forest Service or BLM, unless otherwise specified.

Social, Economic, and Political Systems

A description of social, economic, and political systems provides needed context for agency decisions regarding social and economic objectives. People-oriented policies of the Forest Service and BLM historically have had a local focus, emphasizing the well-being of individuals, user groups, and communities that are socially or economically connected to federal lands.

Human social, economic, and political systems are described and analyzed differently from one another, although there may be substantial overlap. Social units include individuals, families, small groups, societies, and cultures. Political units include communities, cities, counties, states, tribes, and the nation. The administrative units of the Forest Service and BLM are political entities. Economic systems are extensions of both social and political systems.

Politicians and agency managers seek to influence and contribute to economic activity within their respective jurisdictions. However, the nature of economic systems limits this influence. Economies change as resources constantly shift to more efficient uses according to market forces, changing technologies, and consumer preferences. Rather than a hierarchical structure of separate "units," economies are a complex web of interdependent economic relationships operating across many jurisdictions, both public and private, over a large area. The ability of political leaders and agency managers to achieve local economic objectives is limited by their ability to anticipate, account for, and influence larger economic forces.

Another factor relevant to economic and social objectives is the size of the area over which land

Major Changes from the Draft EISs

Social-Economics

Number of Communities and Counties

The original project area covered parts of seven states and 100 counties. Deletion from the project area of the small portions of the basin within Nevada, Utah, and Wyoming (see Chapter 1) reduced the number of counties within the area by seven and the number of communities tracked by the U.S. Census by six. Skamania County, Washington, was also deleted, as it falls completely within the area covered by the Northwest Forest Plan (which also was removed from the project area, see Chapter 1). Some of the analysis work done for the Draft EISs that is carried forward to this Supplement reflects the slightly larger original project area.

Display of Conditions, Trends, and Effects

In the Draft EISs, economic and social effects were discussed by economic subregions, defined as trading areas by the Bureau of Economic Analysis. This Supplemental Draft EIS uses Resource Advisory Council/Provincial Advisory Committee (RAC/PAC) areas as the base level for display of estimated effects, both socio-economic and biophysical. However, because of their relatively broad scale (each RAC/PAC includes several counties, many subbasins, and a wide variety of communities) and their delineation by hydrographic rather than social/economic/political boundaries, RAC/PACs are of limited usefulness in responding to the need to assess social and economic effects at the finer, or more local, scale. Therefore, pertinent economic and social conditions are also described for counties, and to the extent possible, for communities or groups of communities.

Recreation Jobs

In the Draft EISs Haynes and Horne (1997) estimated that, as of 1990, there were approximately 220,000 jobs on lands administered by the Forest Service or BLM associated with livestock grazing, recreation, and timber harvest. Of those, about 190,000 were associated with recreation. In response to comments on the original methodology, and with further review and analysis, the estimate of recreation-associated jobs was reduced to about 77,000 as of 1994 (Crone and Haynes in press), and the total estimate of jobs associated with livestock grazing, recreation, and timber harvest (accounting for some declines in grazing and timber jobs in the first part of the decade) was reduced to 95,000 (Crone and Haynes 1999).

management activities and related products are planned. Effects of land use decisions are difficult to reasonably predict for areas smaller than those for which uses are estimated. For example, if the location of planned timber harvest is a broad multi-county area, the effects on timber-related employment on a smaller area, such as a single county, city, or community can be difficult to predict.

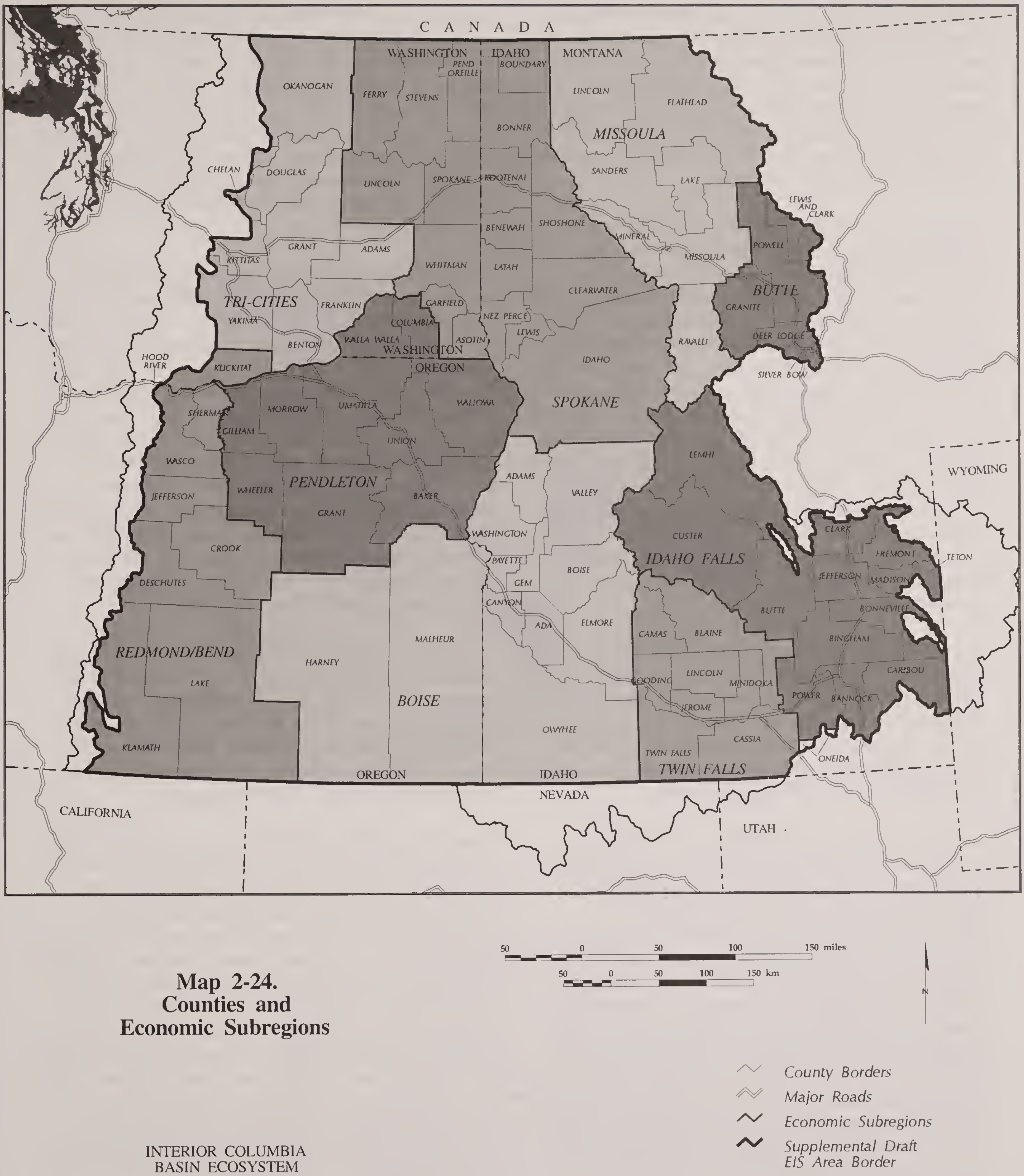
Estimated biophysical and socio-economic effects of land management decisions can be displayed at a number of levels, or scales, each of which provides some useful information. The broadest scale for this planning process is the project area (see Chapter 1 for description). In the Draft EISs, biophysical effects were displayed and evaluated primarily by 13 Ecological Reporting Units (ERUs), which are broad-scale landscape areas delineated on the basis of similar biophysical environments. Economic and social effects were discussed by economic subregions, defined as trading areas by the Bureau of Economic Analysis (Map 2-24).

The Supplemental Draft EIS uses RAC/PAC areas as the base level for display of estimated, biophysical and socio-economic effects in part, based on public comments. Some economic and social conditions are also described for counties, and to the extent possible, for communities or groups of communities, to provide some basis for evaluating probable effects of management alternatives at a more local level. This is discussed further in Chapter 4.

Population

Characterization and Trends

Population density, distribution, and change, along with the demographics of the project area, are useful



Map 2-24. Counties and Economic Subregions

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factors for describing past and potential economic growth and community resiliency. These factors also provide an understanding of how changing federal land uses could affect cultural and social values of people living in the project area. High population density can be an important indicator of the resiliency of economic systems, because it generally corresponds to areas with high economic diversity.

The project area is sparsely populated, with a density of approximately 11 people per square mile compared to the national average of 70. Population density also differs greatly by county. Nearly half of the population of the project area is located in 12 of the 92 counties, showing a very uneven distribution of population. Only six counties have sufficient population to be classified as metropolitan counties. The total 1998 population in the project area, based on the most recent Bureau of Census estimates, was about 3.3 million people (USDC, Census Bureau, 1999 [a] and [b]). Washington residents constitute 39 percent of the project area population, compared to 37 percent in Idaho, 13 percent in Oregon, and 11 percent in Montana. The most populated county is Spokane, Washington, with a 1998 population of approximately 408,000.

In spite of the recent increases in population, the basin remains far more rural than the U.S. as a whole. Only 31 percent of project area residents live in urban areas, compared to over 77 percent of the U.S. population who live in urban areas. Over 90 percent of the 470 communities in the basin are considered to be rural (Harris, Brown, and McLaughlin 1995).

The basin has a greater proportion of whites (92 percent) and of American Indians (2.4 percent) than the nation as a whole (80 percent and 0.8 percent, respectively), and smaller proportions of African-Americans, Hispanics, and Asians. The percentage of residents of the project area with at least a high school diploma and at least some college education is greater than the national average. The population age distribution is similar to the national average, but with a somewhat larger percentage of people under 18 years of age in the basin, and a somewhat smaller proportion of people in the prime wage-earning years (25 to 49). For additional discussion of demographics in the interior Columbia Basin, see Haynes and Horne (1997) and McGinnis and Christensen (1996).

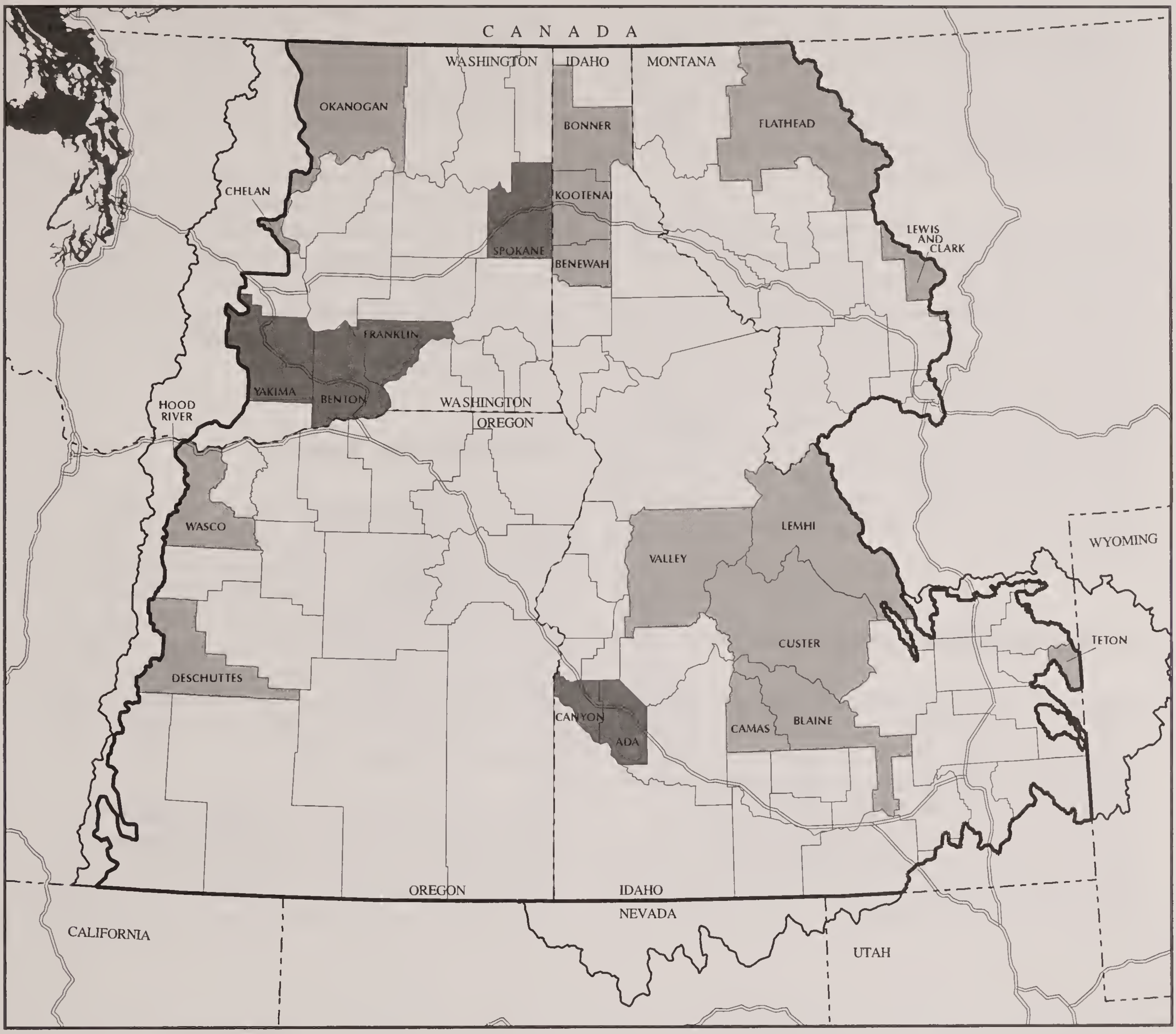
There are 19 American Indian reservations and one colony, some with and some without trust lands, that are wholly or partially within the interior basin counties. (Several of these lie outside the actual project area boundary, but are within a county that is at least partially within the project area.) These lands cover about 8,950,000 acres, or approximately 5 percent of the land base of the project area. However, in six counties, reservation and trust lands account for more than 40 percent of the land base. In 1990, approximately 115,000 people—not all American Indian— (four percent of the project area population) lived within the borders of these lands. See the Federal Trust Responsibility/Tribal Rights and Interests section, Appendix 8, and Hanes (1995) for further discussions.

In the interior Columbia River Basin, the rate of population change differs among counties. From 1960 through the early 1990s, a study of population figures by county reveals three distinct patterns. The most predominant pattern showed a decrease in the 1960s, reflecting the national trend of rural-to-urban net migration; followed by a reversal of that trend and a gain (or only minor losses) in population for many interior Columbia River Basin counties in the 1970s (again, reflecting a national "rural renaissance" trend); followed once more in the 1980s by a resumption of the rural-to-urban migration pattern (Johnson 1993); and finally capped by a relatively significant upturn in most interior basin county populations during the first part of the 1990s.

Two alternate patterns were experienced on the one hand, by the largest (and generally least populated) counties, which steadily lost population from 1960 through the early 1990s; and, on the other hand, by the more populated, urbanized, or recreation and tourism counties, which saw continued population growth through the entire 35-year period.

Counties in which recreation and tourism play a large role in the county economy showed large increases in population (Johnson and Beale 1995) (Map 2-25). These 16 counties with substantial recreation accounted for only 16 percent of the basin's population in 1994, yet they reported about 22 percent of the total population increase in the project area from 1990 to 1994. In these counties, about 77 percent of the population growth is accounted for by net migration (Johnson and Beale 1995), compared to 60 percent and 57 percent in metropolitan and other counties. Counties with high technology manufacturing (such as electronics and instruments) and services (such as medical, business, engineering, and educational) also had relatively high population growth rates during the early 1990s.

Although agriculturally based lifestyles dominate the interior basin, lifestyles differ substantially in rural counties where rapid population growth is occurring. Compared to households nationally, lifestyles in rural rapid growth areas appear to be oriented more toward the natural environment, occupations related



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Map 2-25. Recreation and Metropolitan Counties

- Recreation Counties
- Metropolitan Counties
- County Borders
- Major Roads
- Supplemental Draft EIS Area Border

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to natural resources, and recreation opportunities on federally managed resources (McCool et al. 1997). Lifestyles within the 16 counties in the project area with significant recreation also differ from regional averages, suggesting the importance of environmentally based amenities to the lifestyles of many people moving to the interior basin.

McCool and Haynes (1996) described two projections of future population growth, one based on conservative projections done by the Bureau of Economic Analysis (BEA) and one done by ICBEMP scientists that reflects the more rapid growth actually occurring in the project area (Figure 2-18). Project area population in many areas already exceeds the BEA projection for 5 to 15 years from now, suggesting that the BEA projections may be too conservative. Under the high estimate, the project area' s population would double by the year 2040, although the overall population density would still remain well below the national average.

Urban–Rural–Wildland Interface

Recent and projected population growth is highest in locations known as the urban-rural-wildland interface areas, where developed private lands meet undeveloped public lands. As the population of the United States grows older, and as more individuals and businesses access markets electronically or through airline and other shipping/delivery services, the trend of increasing population migration to rural areas with high quality of life is expected to continue. The resulting growth in numbers of residential dwellings near forested landscapes has presented new challenges in fire prevention and suppression for federal and local agencies (Map 2-26) and has the potential to fragment habitat and increase conflicts with wildlife.

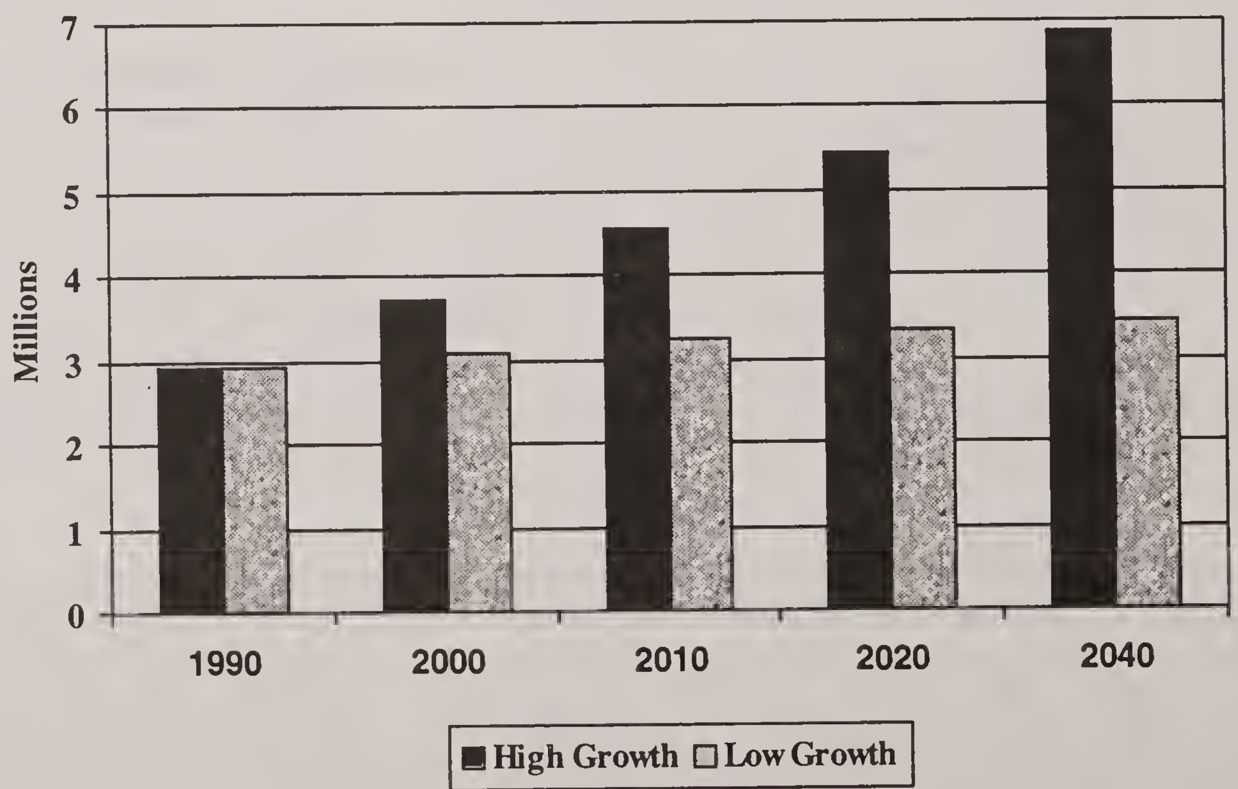
Because of significant concerns about fire protection in urban-rural-wildland interface areas, the Western Governors Association recently initiated an effort involving diverse interests to develop an "Urban/Rural/Wildland Interface Fire Policy Action Report." Federal land managers are called upon in the report to manage fuels in the interface areas (Western Governors Association 1995).

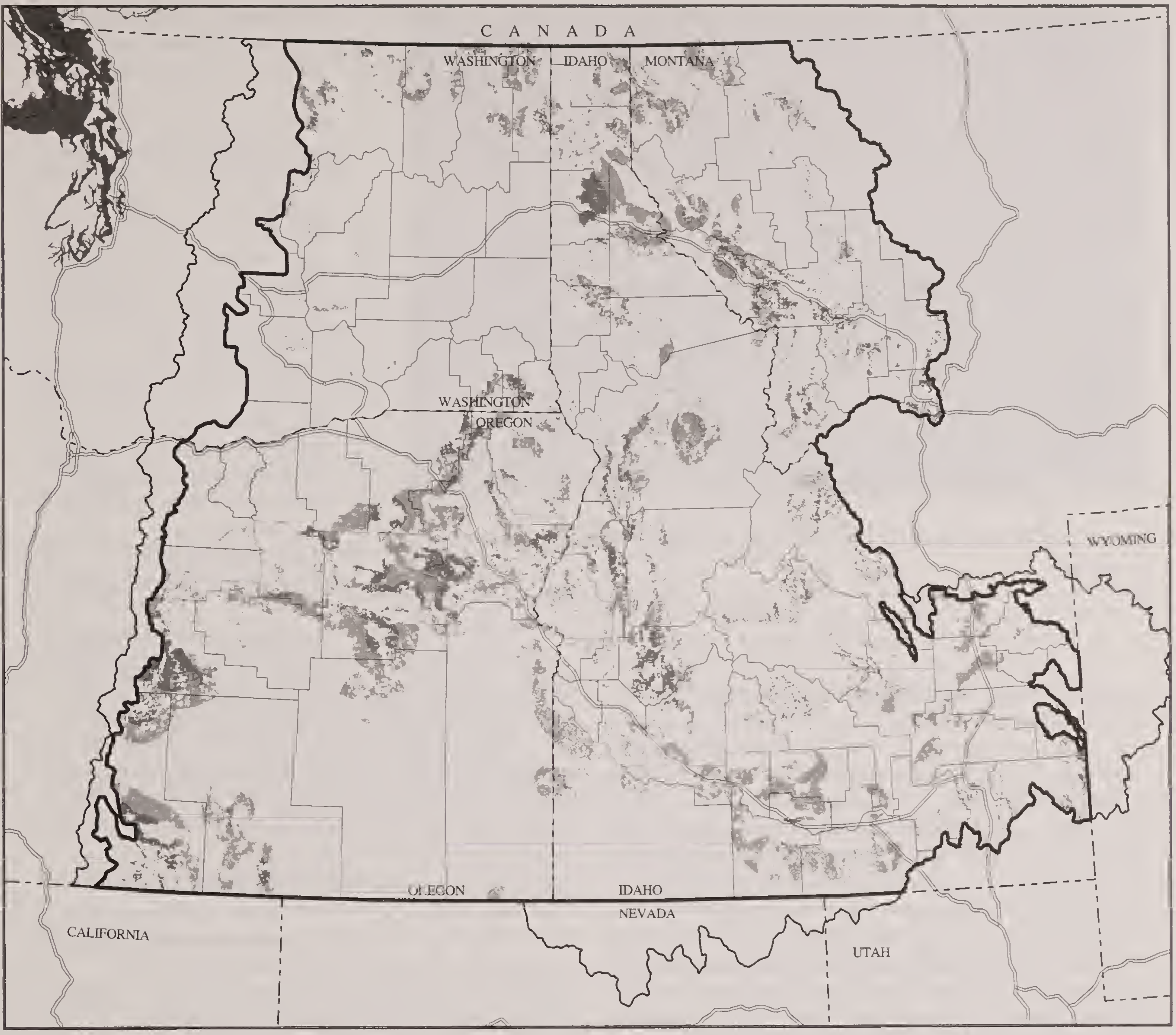
Environmental Justice

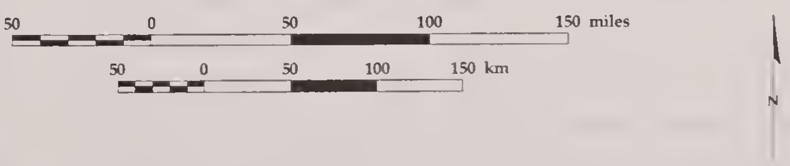
Executive Order 12898 (59 Fed. Reg. 7629, 1994) directs that federal agencies shall identify and address, as appropriate, "...disproportionately high and adverse human health or environmental effects of [their] programs, policies, and activities on minority populations and low-income populations..." Appendix 7 shows per capita income data, poverty rates, and racial/ethnic proportions of populations at the county level. This type of information is not available at the individual community level.

More detailed information on location of American Indian tribes, reservations, and communities associated with reservations is found in other parts of this chapter. Hanes and Hansis (1995) also provide a good overview of the geographic locations, and uses of and

Figure 2-18. Future Population Growth in Project Area. Population of the project area by decade using two different projection assumptions.







Map 2-26.
Urban-Rural-Wildland Interface:
Fire Risk

BLM- and Forest Service-Administered Lands Only

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Moderate Risk
High Risk
County Borders
Major Roads
Supplemental Draft EIS Area Border

Photo by Karen Wattenmaker.

The growth in numbers of homes near forested landscapes is presenting new challenges for fire prevention and suppression.

relationships to the public lands by the American Indian tribes in the basin.

Hanes and Hansis (1995) also provide an overview for other ethnic groups in the basin. The Hispanic population is concentrated in seven river basins, with the largest number living in the Yakima Valley from Ellensburg to the Tri-Cities in Washington; smaller but significant concentrations living along the Snake River in Idaho, Oregon, and Washington, and in the Wenatchee, Washington areas; and smaller numbers living in the Deschutes and Klamath basins in Oregon. Other ethnic minorities are relatively evenly spread throughout the basin. A few concentrations of Japanese-Americans, who are the largest contingent of Asians, are located here as an outcome of the internment camps of World War II. The large number of Southeast Asian users generally travel over from the large urban areas west of the Cascades, but are not generally permanent residents in the basin. The African-American population is small and does not currently use public lands even proportionally to its small numbers.

Hispanics, originally drawn to the interior Columbia River Basin by jobs in irrigated agriculture, have begun to use lands, especially national forests, both for income and recreation. As more and more first and second generation Hispanics work outside the agricultural sector, their use of public lands for recreation has increased and is predicted to continue to increase. Some of this recreation involves large family outings to nearby parks, while increasing numbers of Hispanics hunt, fish and camp on public lands. However, the proportion of Hispanic recreational users is still well below their proportion of the population.

Public lands are also used by large numbers of Hispanics who earn income in forestry-related activities. They are employed by labor contractors to reforest, prune, and thin trees, and they have been employed as firefighters to a lesser extent. Hispanics also have been involved in the harvest of special forest products, such as huckleberries, mushrooms, and beargrass.

Southeast Asians, although a very small minority of the residents of the basin, also use public lands for the harvesting of special forest products. Many come from the west side of the Cascades to harvest mushrooms and floral greens. The harvesting of some of these crops may provide a backdrop for family and social cohesion. In some cases, whole families go to public lands, to camp, harvest forest products, and socialize in extended kin networks (Richards 1994). As with other low-income populations, Hispanic and Asian harvesters could be affected by policies or programs that determine fees for recreation or harvest permits, or which affect water quality or hygiene in harvesters' camp sites.

Members of minority populations are employed in forestry-related activities, including mill work, harvesting, and reforestation. However, data do not currently exist to quantify the actual proportions of minorities in local workforces.

As discussed later in this chapter, road access is an issue for many public land users in the basin, including minority groups. Roads are important for gaining access to public lands for harvesting special forest products, recreating, and accessing places of importance for cultural, spiritual, or recreational reasons. Potential road closures in the basin may be of concern to many of these users.

Chapter 4 discusses potential impacts of changes in federal agency policies and practices on all users, including minority and low-income populations, to the degree practicable at this broad-scale plan.

Additional assessments for effects related to environmental justice are more appropriately conducted at a mid-scale level.

Land Ownership and Major Uses

There are approximately 128.5 million acres of land within the bounds of the project area. Forest Service- or BLM-administered lands make up a substantial portion—63.5 million acres, or just under half—of those lands. Forest Service- or BLM-administered lands were either reserved from settlement or were considered part of the public domain during the early part of the century. These lands are substantial assets that are important to the nation, as well as to the region.

The ownership pattern of the remaining lands includes approximately 6 percent "other federal" plus state, county, and city ownership; 3 percent tribal; and 41 percent private. The proportion of Forest Service- and BLM-administered land varies considerably by county (Map 2-27). Although economic contributions from federal lands to the regional economy are proportionally far less than the land ownership percentages, the local dominance of these lands has important local economic implications, and perhaps even greater social and cultural implications.

Recreation and Scenery

Supply of Recreation

The project area provides recreational opportunities of local, regional, national, and international importance. It has, on average, substantially greater amounts of available outdoor recreation opportunities compared to the national average, much of it supplied by federal lands (Molitor and Bolon 1995). The BLM and Forest Service provide more than 90 percent of the federally managed recreation acres throughout the project area.

Recreation opportunities on public lands in the project area have been inventoried using the Recreation Opportunity Spectrum (ROS), which considers characteristics such as road access, amount of development, density of recreation use, level of facility development, and natural resource management (Clark and Stankey 1979). Combined categories for this project include primitive/semi-primitive (combining primitive, semi-primitive nonmotorized, and semi-primitive motorized classes), roaded natural (roaded natural and roaded modified classes), and rural/urban (rural and urban classes).

The ROS is a convenient way to inventory and display recreation settings, but it does not include the main attractions that draw people to recreation settings, such as water, fish, wildlife, and highly valued scenery. The presence of water has been, and will continue to be, one of the most important draws for recreation visitors. The project area contains an abundance of wild and remote water environments, containing nearly three times the national average.

Federal lands supply large amounts of primitive and semi-primitive recreation opportunities (Map 2-28), much of which has been given special status by the Congress, such as in wilderness or wilderness study areas, wild and scenic rivers, national scenic areas, and national recreation areas. The project area contains 70 percent of unroaded areas in the lower 48 states that are 200,000 acres or larger. Few regions in the lower 48 states can match this combination of large-scale undeveloped areas and low human population density.

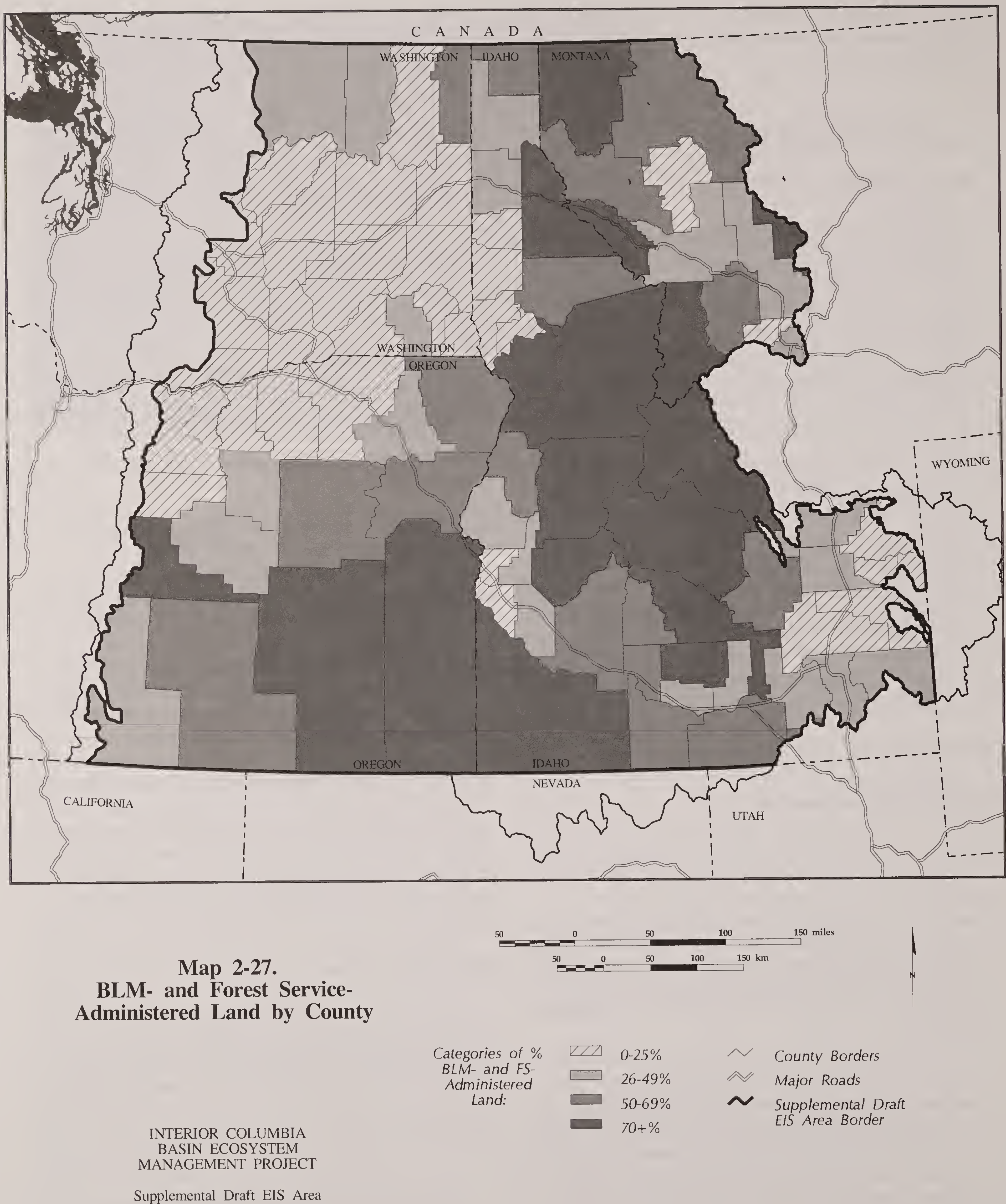
Access to wildland-based recreation opportunities is important to the rural-oriented lifestyle of area residents and contributes importantly to the region's identity. Nationally, the greatest shortages in recreational opportunities are for primitive camping, backpacking, hiking, horseback riding, nature study, and wildlife observation (Haynes and Horne 1997). These are recreational settings for which the project area's agency-administered lands have a comparative advantage over other parts of the country.

In the future, recreation demands for these lands are likely to continue to increase. The basin offers more recreational opportunities, especially in undeveloped and remote settings (primitive and semi-primitive ROS), than other regions of the nation. The relative importance of these opportunities are likely to increase over time.

Recreation Use

Between 1991 and 1993, an average of approximately 72 million recreation visits per year occurred on Forest Service- and BLM-administered lands in the project area (Crone and Haynes in press[a]). Day use and motorized viewing accounted for just over half of the recreation visits. Camping, trail use, winter sports

Road closures in some areas may be beneficial for aquatic and terrestrial habitat, but such closures may also have adverse effects on recreation use.



Map 2-27. BLM- and Forest Service-Administered Land by County

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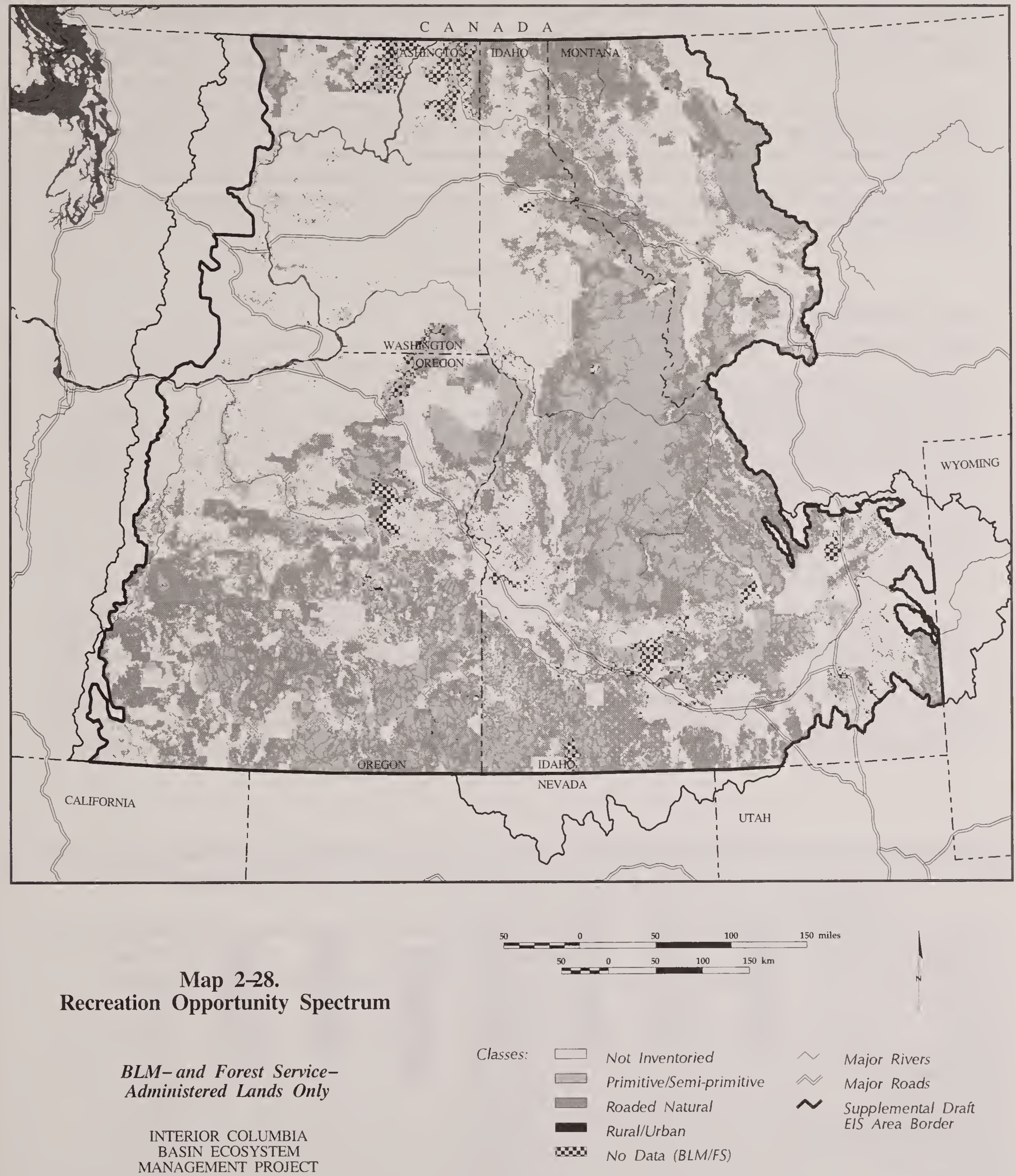

Map 2-28.
Recreation Opportunity Spectrum

BLM- and Forest Service-Administered Lands Only

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and fishing were the next most popular recreation activities, each with 8 to 9.5 percent of the total recreation visits (Table 2-26).

Roaded natural settings receive about 75 percent of all activity days in the project area. Activities such as trail use occur mainly in primitive/semi-primitive areas, while camping is mixed, with about half of the visits occurring in roaded natural settings and one-quarter each in primitive/semi-primitive and rural/urban settings.

Issues in Recreation Supply and Management

Two main issues for recreation management in the basin both deal with roads and access. On one hand, maintaining and potentially increasing over time the supply of unroaded recreation opportunity (primitive/semi-primitive recreation areas) is important to meet the growing regional and national demand for this type of recreation. On the other hand, over half of the recreation use in the project area relies on some form of motorized use and access. As discussed elsewhere in this EIS, the size and condition of the road system on public lands in the project area is a significant concern for both terrestrial and aquatic ecosystem condition and restoration. Budget requirements for road system maintenance are also a major concern. Road closures in some areas may be beneficial for aquatic and terrestrial habitat, but such closures may also have adverse effects on recreation use, depending on the road system, the recreation areas accessed, and current use levels. As discussed later in this section, recreation is a significant and growing contributor to local economies. One challenge in local implementation of the management direction of this plan will be to balance the needs of the biophysical environments with economic, social, and cultural needs when making decisions about which roads should be left open or closed.

Scenery

Scenery is important to both residents of and visitors to the project area, contributing to quality of life and supporting economic benefits through recreation and tourism. According to the Forest Service's 1990 Resources Planning Act program update, viewing scenery has the highest participation rate of any recreation activity in the United States, with approximately 21 percent of the population participating.

Cultural Resources

Federally administered lands must comply with a number of federal laws and regulations protecting cultural resources, including the Antiquities Act and the National Historic Preservation Act. Cultural resources are generally defined as the nonrenewable evidence of human occupation or activity as seen in any area, site, building, structure, artifact, ruin, object, work of art, architecture, or natural feature,

Table 2-26. Estimated Recreation Visits to All Federal Lands in the Interior Columbia Basin (1991–1993 Average).

Recreation Activity	Recreation Visits[1]	% of Total
Camping	6,805,000	9.5
Day Use	17,499,000	24.4
Fishing	5,683,000	7.9
Hunting	3,101,000	4.3
Motor Boating	1,889,000	2.6
Motor Viewing	18,765,000	26.1
Nonmotor Boating	1,294,000	1.8
Off-Highway Vehicle Use	1,690,000	2.4
Snowmobiling	1,776,000	2.5
Trail Use	5,790,000	8.1
Viewing Wildlife	1,803,000	2.5
Winter Sports	5,731,000	8.0
Total	71,826,000	100.1

[1] Rounded to nearest 1,000

Source: Crone and Haynes (in press)

which was important in human history at the national, state, or local level. The project area has been occupied by humans for more than 12,000 years; hence, it has much evidence of human activity. By its very nature this evidence is site-specific and beyond the scope of the broad-scale nature of this EIS. This in no way detracts from the significance of cultural resources or the need to appropriately protect them. The inventory, detailed descriptions, and protection or mitigation of site-specific cultural resources are better discussed on a local basis, and will be addressed in BLM and Forest Service land use plans, activity plans, and other local environmental and ecosystem analyses.

Livestock Grazing and Grazing Fees

Grazing has been an important part of the interior Columbia River Basin since the mid 1800s. Until 1905, livestock operators used public lands on an unregulated basis. Between 1905 and 1934, the Forest Service began to introduce allotments and grazing systems on lands they administered. From 1934 through 1946, with passage of the Taylor Grazing Act, allotment-based grazing was extended to BLM-administered lands. After World War II, both the Forest Service and the BLM began to make expanded investments in range rehabilitation and management as authorized in the Multiple Use-Sustained Yield Act, the Federal Land Policy and Management Act, and the Public Rangelands Improvement Act of 1978. The amount of forage in terms of AUMs that was authorized for use by permittees on BLM- and Forest Service-administered lands during the 1990s is shown in Figure 2-19. (Authorized AUMs may be less than permitted AUMs because of seasonal or multi-year restrictions in grazing, or other agreements limiting actual grazing to lower levels than were permitted). (For a more complete cultural and administrative history of grazing on public lands, see discussions in Frewing-Runyon [1995] and Haynes and Horne [1997]. Also see the Factors Influencing Ecosystems section later in this chapter.)

Livestock operations are an important part of the agriculture sector in the project area. Cattle and calf sales accounted for an average of 29 percent of total agricultural output in the basin as a whole for the period 1982–1992. Sales of cattle raised at least in part on BLM and Forest Service forage accounted for an average of 2 percent of total agricultural sales in the project area. Table 2-27 presents information about the role of agriculture and livestock operations over that time period in the nine BEA economic trade regions constituting the project area (Map 2-24, earlier in this section), and the estimated dependency of cattle and sheep operations on forage produced on federal lands.

The Butte and Missoula BEA areas have the highest percentages of agricultural products sold that come from cattle/calf sales; (They also have the lowest overall agricultural output of the trade regions in the basin). All but one other trade region show cattle/calf sales contributing 30 percent or less to total agricul-

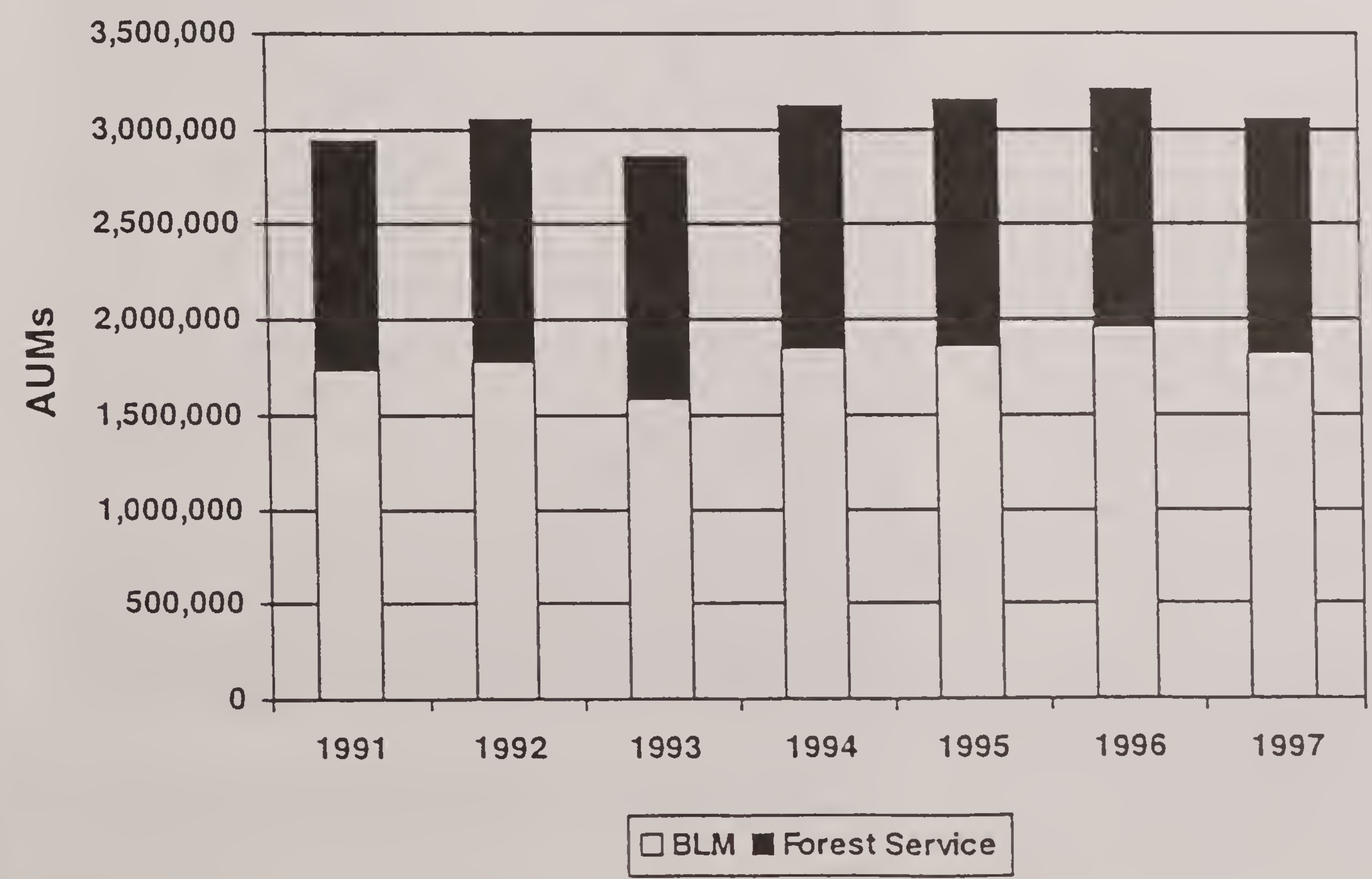


Figure 2-19. Estimated Authorized Forage Use on Permitted BLM- and Forest Service-Administered Lands in the Project Area.

Table 2-27. Role of Agriculture and Cattle and Calf Sales in Regional Economies of the Project Area (Average 1982–1992).

BEA Regions	Farm/Ranch Income as Percent of Total Labor Income	Value of Agricultural Products Sold (millions of 1992 $)	Cattle/Calf Sales as Percent of Total Agricultural Output	Dependency on Federal AUMs[1]
Tri-Cities	12.3	2,196	22.3	1.4
Spokane	3.0	646	14.5	2.5
Missoula	0.7	117	48.1	1.0
Idaho Falls	7.8	852	25.6	11.2
Twin Falls	17.2	962	30.1	6.1
Boise	4.5	1,098	45.4	11.9
Pendleton	9.5	780	30.0	6.6
Redmond-Bend	5.0	388	30.1	9.1
Butte	0.4	57	76.2	2.4
Total Project Area	**6.6**	**7,096**	**28.8**	**7.0**

[1] Dependency is defined as the portion of total feed consumed by cattle and sheep in an area provided by permitted use of Forest Service- and BLM-administered lands. The column displaying dependency on federal land AUMs understates rancher dependency on federal grazing permits due to the nature of seasonal grazing systems and the number of cattle in feedlots and dairies that also consume feed and contribute to total cattle/calf sales. DeForest (in Haynes and Horne, 1997, p. 1769) calculates that accounting for seasonal use patterns could increase dependency figures by 20 percent.

Source: Frewing-Runyon 1995.

tural output. Dependency on federal lands for cattle and sheep feed/forage (measured in Animal Unit Months) ranges from 12 percent down to 1 percent.

However, figures for these large geographic areas mask much higher variability by county. For instance Frewing-Runyon (1995) found cattle/calf sales contribution to value of agricultural output ranging from a high of 92 percent to less than 1 percent. Dependency on federal forage ranged from about 40 percent to none.

Even county-level information masks variability among communities within counties. Reyna (1998) derived industry "specialization ratios" for 411 communities in the project area, which compare the proportion of jobs in an industry sector at the community level with the same proportion of jobs found in that industry over a broader area, such as the regional trade area within which the community falls. A ratio greater than one indicates that the local community has a greater proportion of its employment in that sector when compared to the broader economic region—that is, the local economy tends to be specialized in that industry. The larger the ratio, the more specialized the local economy. Reyna's results show that economic specialization in an industry such as agriculture, or agricultural services, can vary from none to very high among communities within any one county.

It is apparent from this information that changes in federal land management policies that affect livestock grazing on federal lands, or that increase the costs of grazing, have impacts that vary from region to region, from county to county, and from community to community. Similarly, the ability of individual ranches to cope with changes in federal grazing policies and practices varies depending on the size of the herd, dependence on federal forage, availability and cost of alternative sources of feed and forage, amount of debt, interest rates on that debt, and the percent of household income coming from off-ranch employment or business activity(ies).

Holders of BLM or Forest Service gazing permits typically run larger, more profitable operations than non-permit holders (Haynes and Horne 1997). Holders of federal grazing permits do not rely solely on Forest Service- or BLM-administered lands for livestock forage. In fact, federal forage as a percent of total feed for cattle is less than 25 percent on average in the four states within the basin (Table 2-28). For sheep, the figure is somewhat higher (sheep operations make up less than 20 percent of total federal grazing permittees, and the average number of sheep run per permittee is generally significantly lower than cattle).

However, average dependency on Forest Service and BLM forage does not wholly represent the reliance of

Table 2-28. Average Dependency of Federal Grazing Permittees on Federal Forage, 1992.

State	Number of Permittees	Cattle Dependent	Sheep Dependent
Idaho	3,675	23%	35%
Montana	4,710	11%	35%
Oregon	1,790	23%	27%
Washington	450	13%	0%

Source: USDI BLM 1994a.

permittees on this forage. Federal forage often is more significant to ranchers than suggested by total supply figures because of seasonal grazing patterns. It is not the total feed, but the number of livestock feeding part of the year on federal range, that many stress as an important factor. Seasonal use of Forest Service- and BLM-administered lands occurs approximately 25 to 30 percent during spring, 24 to 30 percent during summer, 21 to 27 percent during fall, and 2 to 7 percent in during winter (Haynes and Horne 1997).

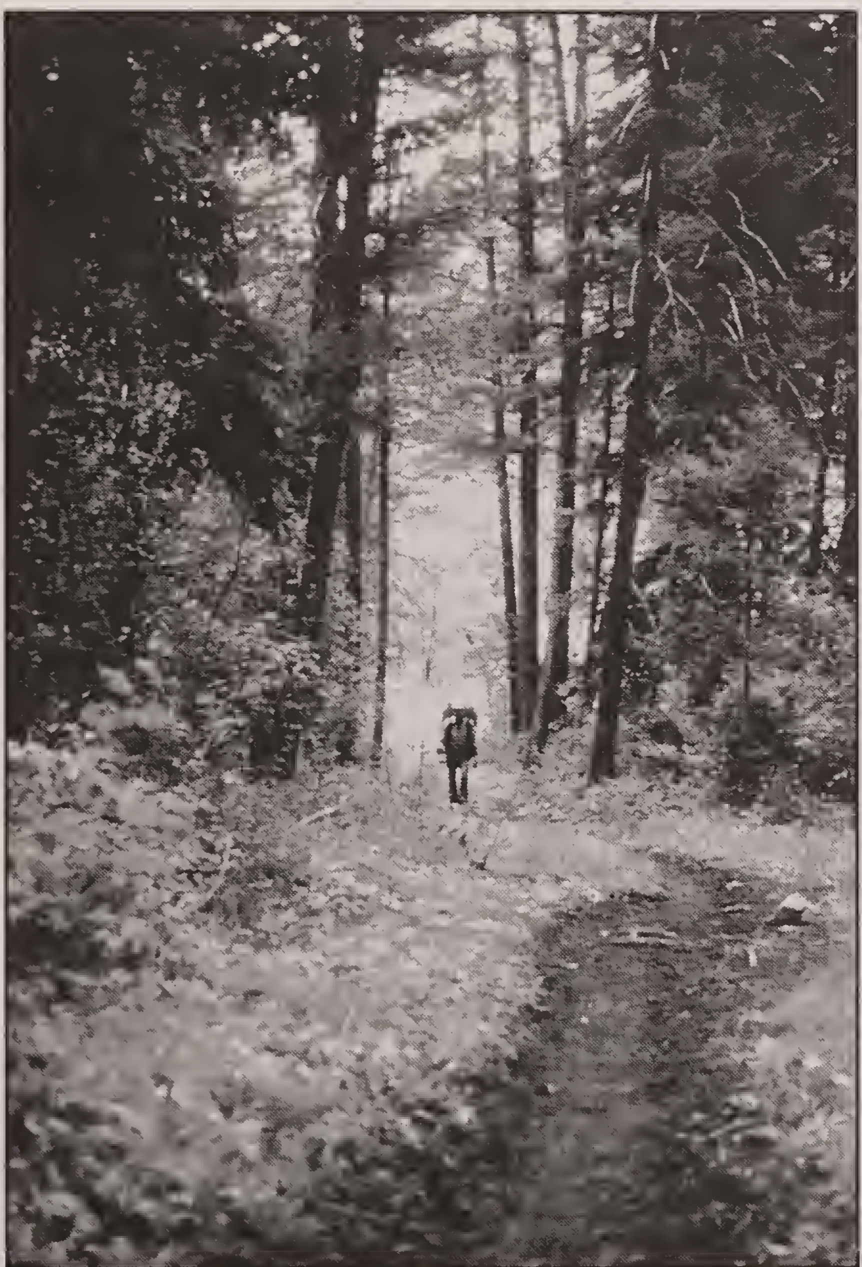


Photo by Doug Basford.

Trail use in less-developed settings is expected to be one of the fastest growing recreation activities in the project area.

The Departments of Interior and Agriculture projected in 1994 that the number of cattle grazing on public lands will decline by about one percent per year for the next 20 years (Haynes and Horne 1997). This expected decline reflects stocking rate reductions from recognition of continuing resource damage, a declining economic feasibility of livestock grazing, and implementation of recovery plans for federally listed species.

Evidence also indicates that as ranchers grow older, more operators leave the profession than enter it. In some rural areas that are experiencing population growth, base properties (home ranches) on which herds overwinter are being converted to resort or residential developments or to dairy operations. For sheep, the elimination of the wool subsidy resulted in some marginally profitable operations selling off all of their lambs, rather than retaining female lambs as replacement ewes. These, and other ongoing trends, are acting to reduce the size of herds and flocks operating on Forest Service- and BLM-administered lands (USDI BLM 1994a).

Grazing fees for most western public lands administered by the BLM and Forest Service have been $1.35 per animal unit month (AUM) since 1996, down $0.26 from 1995. The formula used for calculating the fee, established by Congress in the 1978

Access to wildland-based recreational activities, such as fishing, is important to the lifestyle of area residents– no matter what their age.

The project area contains world-class salmon and trout recreational fisheries.

Photo by Doug Basford.

Public Rangeland Improvement Act, has continued under a presidential executive order issued in 1986, in which the grazing fee cannot fall below $1.35 per AUM. The annually adjusted grazing fee, which takes effect every March 1, is computed by using a 1966 base value of $1.23 per AUM, which is then adjusted according to three factors: current private grazing land lease rates, beef cattle prices, and the cost of livestock production. The fee decreased for 1996, and has remained at the minimum level because of lower beef cattle prices and higher production costs.

Commercial Timber Harvest and Other Forest Products

Regional Trends

Timber supply and demand are determined by the simultaneous interaction of global, national, regional, and local consumers, producers, and land owners. As a proportion of the total United States harvest, timber harvest levels in the project area have declined from a 1970 high of 13 percent to about 10 percent today. Harvest levels as a percent of the national total are expected to decline only slightly below that figure over the next 30 to 40 years.

Although harvest levels in the project area declined as a proportion of the national total, harvest in actual volume terms (million cubic feet) from all owners actually increased about 12 percent from 1970 to 1991. Between 1986 and 1991, increases in harvests from other public and private lands offset declines from National Forest System and forest industry lands.

By 1991, timber harvest from all public lands had dropped to about 52 percent of the total for the project area, compared to about 56 percent in 1986, and nearly 60 percent in 1970. Harvest from BLM-administered lands historically has been 10 to 15 percent of that total.

During the 1990s, there has been a significant decline in timber harvest from federal lands, partly because management changes have taken place to protect habitats of threatened, endangered, and other species of concern from further degradation, but with some contribution from softening demand for timber, and competition from imports that occurred in the latter part of the decade. In the past 40 years, federal lands supplied up to 60 percent of timber harvest from the project area; that contribution is expected to be only about 35 percent over the next 30 to 40 years (Haynes and Horne 1997).

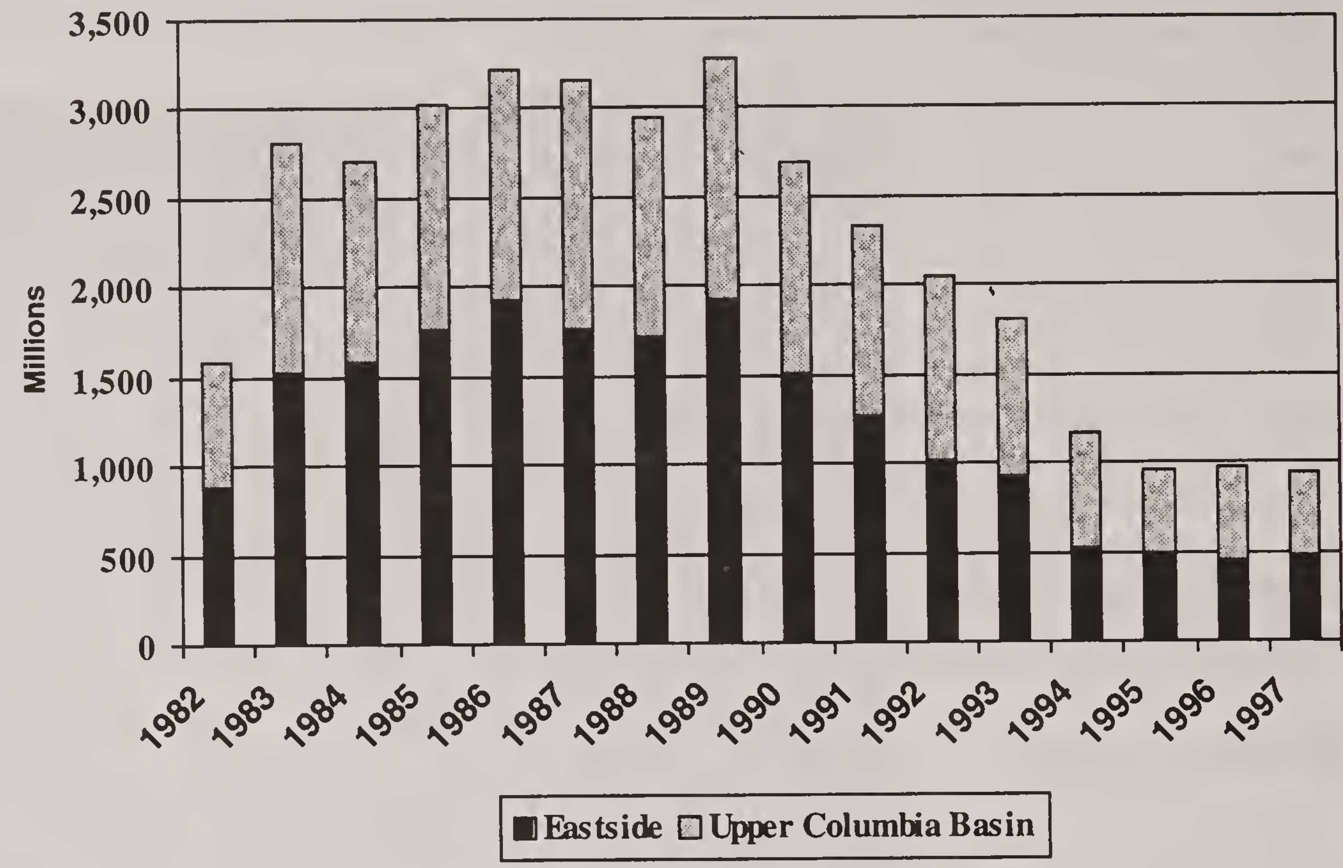
As shown in Figure 2-20, harvest volume from National Forest System lands, which account for 85 to 90 percent of federal lands harvest in the project area, decreased from a 1989 high of almost 3.3 billion board feet to just under 1.2 billion within five years. It dropped further to 949 million board feet by 1997—an overall decline of 71 percent in nine years. Note, however, that the National Forest System timber harvest was only 1.5 billion board feet in 1982, and then doubled as the nation came out of the economic recession of the early 1980s, following the traditional cyclical pattern of the timber industry.

Photo by Melanie Miller.

Livestock grazing has been an important part of the interior Columbia River Basin since the mid 1800s.

It is not possible to draw specific conclusions about the relationships among timber harvest from federal lands, economic specialization in wood products manufacturing, and economic status of individual counties or communities. The proportion of National Forest System timber as a percentage of total harvest from individual counties varies widely, from none to as high as 95 percent. But, just as with range and livestock, Reyna (1998) found that the county-level information masks variability among communities within counties. Those economic specialization ratios show that specialization in the wood products manufacturing sector for communities within a county can range from none to very high.

Figure 2-20. Timber Harvested from National Forest System Lands in the Interior Columbia Basin, 1982–1997.



There can be several reasons for these variations. Often, wood products mills may be located in only one or two towns in a sparsely populated county. Or, a mill may be physically located between two communities, both of which rely on the mill for employment, but the mill's physical or postal address associates it with just one of the communities. Communities in counties that have fairly low harvest from federal lands may be highly specialized in wood products manufacturing because of harvest available from private lands. And, finally, depending on geography, transportation infrastructure, and trade patterns, a community in a county with little federal lands harvest may still have mills that draw timber supply from federal lands harvest in adjacent counties. Conversely, because of the same factors, a county with a high percentage of federal lands harvest may have much of the harvest volume go to mills in other counties.

Declining and less predictable federal timber availability, along with technological and other changes in the forest products industry, have affected people directly through job losses and indirectly through effects on federal government revenue sharing.

Because of competition with outside buyers, local mills can no longer assume they can compete for local timber sales, even when the volume of timber for sale in an area is maintained or increased. In 1994, concern with "outside" competition even led to a proposal for an "Inland Empire" sustained yield unit that would have encompassed most national forests in the upper Columbia River Basin portion of the project area. This proposal would have excluded participation of timber purchasers from western and central Oregon and Washington in timber sales on national forests in the upper Columbia River Basin, bringing relief to mills in the upper basin that were competing for timber sales in the area. Although never adopted, it is an indication of the concern for maintaining the economic viability of local mills and communities.

Declining and less predictable federal timber availability, along with technological and other changes in the forest products industry, have affected people. The former has resulted from two major factors: actual reductions of timber availability caused by declining forest health; and the challenges and complexities of meeting current regulations and policies in relation to broader issues such as ecosystem health, declines in anadromous fish runs, and concerns for the health of other plant and animal species. These effects have contributed to decreasing employment opportunities for forest products employment, which in turn have contributed to economic and social hardships in communities with high employment in firms dependent on federal timber. Declining

timber availability has affected people directly through job losses and indirectly through effects on federal government revenue sharing, with reduced funds for schools and roads.

Special Forest Products

Because of the economic significance of logging and milling, the role of special forest products is sometimes overlooked. However, the collection of forest plants for commercial processing and trade in the project area is a small but growing industry. It is estimated that this industry is already producing several hundred million dollars per year in product sales. More than three-fifths of this value came from floral greens and Christmas ornamentals. Other significant special forest products include wild edible mushrooms, huckleberries, and medicinals. In this industry, an estimated 70 percent of jobs involve low-paying and seasonal harvesting activities. The other 30 percent of jobs, which are better paying, are in processing and marketing (Schlosser and Blatner 1994).

The number of permits granted to collect special forest and range products is expected to increase substantially. This will result in the need to manage the resource to assure it remains sustainable. Adjustments to forest and range management practices may be necessary to meet the growth needs of species used as special forest products.

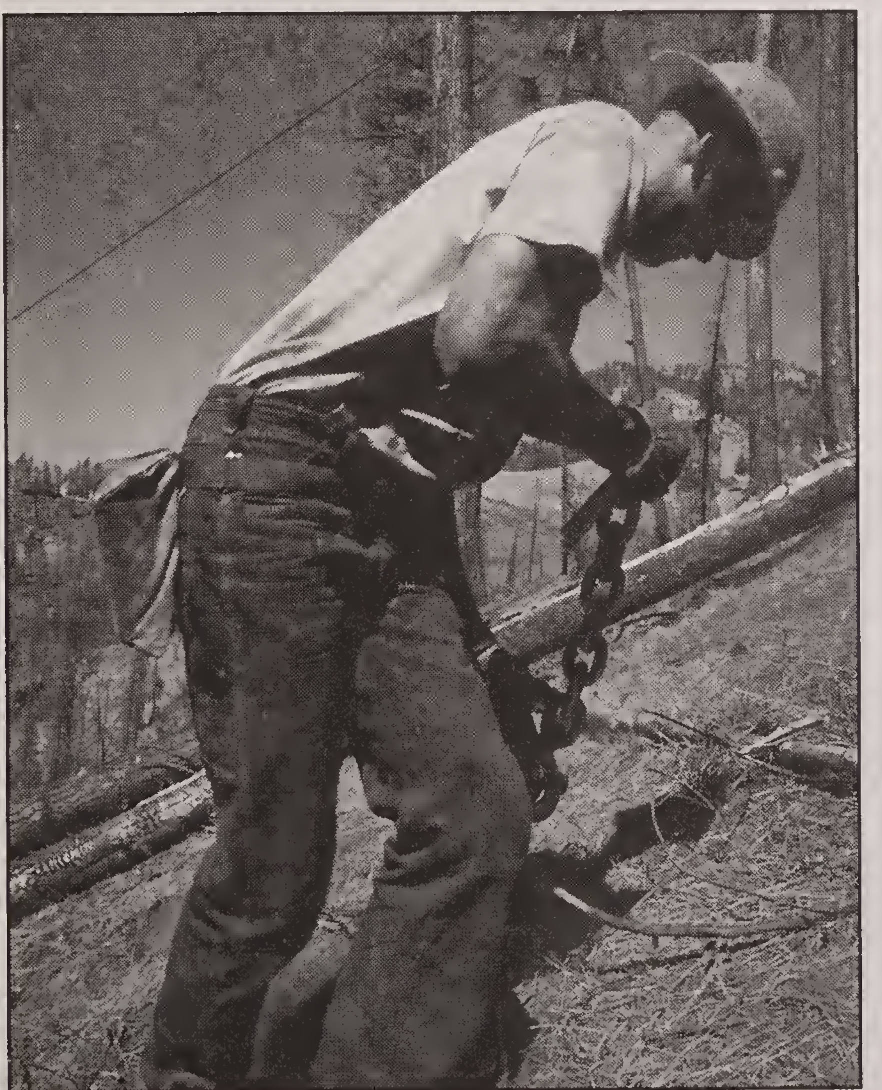


Photo by Ravi Miro Fry.

In 1991, timber harvest from Forest Service-administered lands accounted for 46 percent of the project area.

Minerals and Energy

For more than a century, mining of deposits of gold, silver, and other base metals—including copper, lead, and zinc—has contributed to the regional economy. Extraction of other metals, including aluminum, molybdenum, tungsten, nickel, chromium, magnesium and antimony have also contributed to the regional and local economies. Production of nonmetallic minerals, particularly phosphate rock, have been another source of regional mining economic activity. Common variety minerals (natural aggregates including sand, gravel and crushed rock) have been important to local economies throughout the project area for construction and repair of infrastructure, including roads, buildings, runways, dams, canals, etc. (See Eastside Draft EIS Appendix 2-3, 1997; and Haynes and Horne 1997 for more details on mineral deposits and values in the basin.) Development of coal, oil, natural gas, and geothermal resources has also been locally important. Discovery and development of oil, natural gas, and geothermal resources may expand in the future. No coal is expected to be mined within the project area in the foreseeable future. (See the Eastside Draft EIS, Appendix 2-3.)

The majority of the mineral industry in the project area is localized in a relatively few counties. However, production of some minerals from the basin has been significant, both nationally and internationally. For instance, phosphate production represents 12 percent of national and 4 percent of world phosphate production. Silver production constitutes 30 percent of national and 4 percent of world output. Gold from Montana, Idaho, and Washington accounts for 11 percent of national and 1.5 percent of world output. Most metal mining activity has occurred in the Upper Columbia River Basin portion of the project area. The Butte (Montana) and Coeur d'Alene (Idaho) mining districts have contributed more than 90 percent of all the base-metal and silver produced in the basin (Haynes and Horne 1997). Phosphate production is focused in Caribou County in southeastern Idaho.

Exploration and development of locatable or hard rock minerals is authorized and regulated principally by the Mining Law of 1872; by the

Mineral Leasing Act of 1920 for phosphate rock, and oil and gas; and by the Mineral Materials Act of 1947 for common variety or saleable minerals. Mining operations must also comply with other federal laws, including the Clean Water Act. The Forest Service and Bureau of Land Management have limited authority to regulate or preclude mining activities on federal lands because of the preeminent authority held by the mining laws mentioned. However, the agencies can stipulate mitigation requirements on mines that are operating, or are proposing to operate, under valid existing rights in order to protect or minimize impacts on resources and to assure reclamation of disturbed land.

Mineral exploration and production activities now represent a small and declining (on a proportional basis) part of the basin's economy. Employment in the mining industry averaged less than 0.5 percent of total employment in 1996 in the project area (excluding northern Nevada and western Wyoming). This was somewhat lower than the national average of 0.58 percent (Crone and Haynes in 1999). Because mining is generally a higher-wage industry, earnings from mining employment would amount to a somewhat higher percentage of total earnings in the basin—probably about 1.2 percent, based on 1990 employment/earnings relationships.

Reyna (1998) found 49 communities in 32 counties (33 communities in 19 counties just in Idaho) that have an economic specialization in mining. Mining is important to jobs, income, and infrastructure in and around those communities. But when compared with the large, diverse and growing economy of the entire basin, it represents a relatively minor share of gross state product (GSP) in the project area. In 1990, mining, including aggregates, was estimated to have contributed 4.2 percent of the total economic activity (GSP) in the project area, including those portions of Nevada, Utah, and Wyoming falling within the project area as defined in the Draft EISs. Over three-fourths of this contribution to the regional economy was from nonfuel minerals, a share which, in relative terms, is significantly above the one percent contribution of nonfuel minerals to the national economy (Haynes and Horne 1997).

Substantial areas of mineral deposits still remain in the project area for potential future exploitation. Whether mining activity will occur in the future for any given deposit will depend on a number of factors, including the type of mineral, size and grade of deposit, national and global demand and prices, technology, and access. Most of these factors are not affected by BLM or Forest Service policy or regulation. The major effect the agencies can have is on production costs through mitigation requirements for mining operations and access.

Road System

Road access is important to many users. It supports the bulk of economic activity generated from federal lands and represents a substantial public investment. This discussion describes the amount and type of

Mining has contributed to the regional economy for more than a century.

Photo by USFS/Boise NF

roads on agency lands, construction and maintenance costs for the road system, and the human uses and values attributed to roaded and unroaded areas.

Road Inventory

The inventoried road system on Forest Service- or BLM-administered land in the project area includes approximately 91,300 miles of roads. A large proportion (80 to 85 percent) of the roads serve high clearance vehicles (roads designed and maintained to a low standard), leaving 15 to 20 percent of roads for passenger vehicles (roads designed and maintained to a high standard). Low standard roads provide for operational needs for most land and resource management and protection, and they also provide dispersed, roaded recreation. The remaining high standard roads serve both management and concentrated recreation use. It is estimated that about 30 percent of the low standard roads are closed to the public by gates or earth barriers for all or most of the year.

Construction and Maintenance Costs

Roads are tangible physical and financial assets that represent a substantial commitment of public land and capital. Roads in the project area typically cost from $10,000 to $150,000 per mile to construct and $100 to $1,600 per mile annually to maintain, depending on the topography and type of road built. Based on current construction costs, the road system would cost approximately $1.8 billion to build today. Historically, commercial timber harvest paid for 90 percent of construction costs and 70 percent of maintenance costs. The rest were funded by congressional appropriations. The deferred maintenance process has identified a needed annual budget of approximately $85 million to maintain a road system of 91,000 miles. The total funds appropriated are less than 30 percent of that. In addition to direct budget costs, roads reduce or eliminate the productive capacity of those acres committed to the road prism and waste areas.

Currently in the Pacific Northwest, national forests are approximately 30 to 50 percent short of funds needed to maintain the current road system to existing standards. Construction and reconstruction funds decreased from about $200 million in 1980 to $25 million in 1995. This reflects both lower appropriated funding as well as declines associated with purchaser credits from timber sales (which declined from 5.2 billion board feet in 1980 to less than 1 billion in 1995). Use of the transportation system on Pacific Northwest national forests has changed over the past decade. In the 1980s, road usage was approximately 70 percent timber harvest, 20 percent recreation, and 10 percent administrative traffic. Since the reduction in timber sale programs, this has shifted to 35 percent timber, 60 percent recreation, and 5 percent administrative traffic (Kozlow 1995).

Economic and Social Importance

Roads have enabled most of the economic activity generated by federal lands in the project area to take place, such as timber management and harvest, grazing access, access to mining operations, and gathering special forest products. Roads are also integral to, or provide access to, most recreation uses, including winter recreation. However, increasing scarcity of unroaded areas and appreciation for benefits of unroaded lands result in substantial nonmarket values associated with those unroaded lands. The benefits of unroaded areas can include high quality water, good habitat for wildlife and fish, ecosystems with limited human disturbance, scenery, primitive recreation, and existence value (the value people place on knowing that wild unroaded lands exist, even if they don't physically visit those lands). The extent of road development is critical for determining whether an area is considered for wilderness or similar designation. Building roads in areas previously valued for their unroaded condition generates a cost for lost opportunity, in addition to added benefits associated with automobile access.

American Indians have used roads built during this century for faster and easier access to traditional hunting, fishing, and gathering grounds, as well as to some cultural and spiritual sites. Yet roads have also disrupted the natural characteristics of many cultural and spiritual sites and areas. And they have made access easier for non-Indians, increasing disturbance at traditional sites and opening the way for greater competition for fish, game, and plants at traditional fishing, hunting, and gathering sites. Tribes are interested in road management policies that would in some instances continue to provide tribal access but restrict non-tribal use, at least during certain times of the year.

In order to restore or protect certain environmental conditions, road management options now include various degrees of road closures, lower maintenance levels, and full road obliteration. This "disinvestment" approach is also a logical response to reduced road maintenance funding that can be expected if commercial use decreases and congressional appropriations do not make up the difference. Costs of this strategy include the cost of closing and obliterating roads, short-term environmental costs, and lost access to managers and the public. The total cost of lost access depends on miles of roads closed, road maintenance class, and location.

Physical and Biological Effects

Road construction and use have been found to have potentially major consequences on both physical and biological ecosystem components. Building roads in steep terrain may destabilize soil and geological structures, causing minor to major road failures and resulting sediment and other debris in streams below the road. Major slumps can cause serious erosion and loss of vegetation, and may contribute to downstream property damage from landslides or associated flooding and mudflows. Sedimentation of streams is known to have adverse effects on fish and other aquatic populations, destroying food sources, filling in spawning gravels, and even causing major changes in stream character (for example, scouring, bank erosion, channel straightening, and flushing out large woody debris).

Road construction can also have negative effects on wildlife populations. Research has shown in recent years that many animals associated with undisturbed late-successional forest are sensitive to interactions with humans and vehicles that roads bring. Wildlife populations may avoid areas after roads are built, effectively fragmenting habitat and making dispersal and interbreeding more difficult. Animals may run from the sight or sound of people and vehicles, using energy they would not normally expend. This can be especially critical during high-stress times of the year, such as breeding, bearing young, or during lean winter months. Roads also provide humans access to wildlife populations for easier hunting as well as poaching.

Additional discussions of roads, road densities, and their effects on aquatic and terrestrial wildlife and plant species may be found in the Factors of Influence section, later in this chapter.

Economic and Social Characteristics and Relationships

A discussion of the different kinds of economic contributions that National Forest- or BLM-administered lands provide society is important because land-use choices will benefit people differently. Recognition of these differences is important for achieving economic and social goals.

Local, Regional, and National Uses

Traditional commodity uses of Forest Service- or BLM-administered lands have favored local use and generated local income. Uses that are now growing in importance favor regional and national users and interests over local use and generate benefits accordingly. This can be interpreted as a shift of Forest Service- or BLM-administered lands from being primarily local and regional assets to being regional and national assets. While these lands have always been national assets by definition, the actual use and way the lands are valued increasingly reflect this.

Traditional commodities produced from federal lands, particularly timber, have generally carried market prices, or prices at least similar to what would be found in private economic markets. These goods have been paid for directly by the purchaser, who then either did the processing or sold them to a processor. As the goods change hands and move from raw material stage to finished product (whether a board or a side of beef), money also exchanges hands which then makes its way into the local and regional economies through payments to workers, purchases of supplies and materials, and so forth. These expenditures create the classic economic "ripple effect," whereby an initial payment supports more economic activity that just the initial one. In addition, government revenue-sharing payments (such as 25 percent payments to counties), provide additional economic support to local areas. Typically, local areas closest to the federal lands have reaped substantial economic benefits from their adjacency to available resources.

There is a growing difference between valuing Forest Service- or BLM-administered lands based on how they serve national demands versus economic contributions they make locally. The economic value and societal importance of these lands continue to increase as use increases and as the unique attributes they possess become more scarce. However, this increased value does not necessarily generate income to support local jobs or other economic activity, and it does not necesarily generate funds to support local government investments in infrastructure or social services that traditional commodity production generated. Much of the value is captured by those living elsewhere, who either travel to federal lands to recreate, use water downstream from federal lands, catch fish

While these lands have always been national assets by definition, the actual use and way the lands are valued increasingly reflect this. There is no question that project area resources have national value aside from their role in the local and regional marketplace.

spawned in federally managed streams, or benefit from the protection of important federally-managed ecosystems. A complete accounting of economic benefits would include value obtained by people who may not ever visit the project area, but who benefit from knowing it exists now and in the future. Often referred to as existence or preservation value (Duffield et al. 1994), these indirect benefits can be substantially greater than benefits flowing from direct use of a resource. The magnitude of the numbers are subject to dispute, but there is no question that project area resources have national value aside from their role in the local and regional marketplace.

Payments to Local Government

The Forest Service and BLM make payments to counties to compensate them for the non-taxable status of the federal lands in their jurisdiction. The formulas used to calculate the amount of money received vary by agency and product. Generally there is a "per acre" payment associated with county population (PILT, or Payments In Lieu of Taxes), and an additional "revenue-sharing" payment based on revenues received by the federal government from timber sales, grazing fees, recreation fees, special use permits, and other uses. Appendix 7 shows percentages of county budgets made up of federal PILT and other revenue-sharing payments in the early 1990s.

Potential reductions in these payments caused by changes in federal land uses are a concern to county governments who rely on this revenue. For counties within the jurisdiction of the Northwest Forest Plan (Western Oregon, Western Washington, Nothern California), the Congress passed legislation to guarantee a major portion of historical payments to those counties whose payments would otherwise have dropped substantially because of the major decline in timber harvests as a result of spotted owl protection measures. Under the current legislation, the percentage of the payments guaranteed drops by 3 percent per year through 2003, at which time they will end.

The governments of sparsely populated counties and rural communities may be relatively unprepared to deal with the kinds of changes in revenue sharing that might result from fundamental shifts in federal land management policies. Rural governments are mostly part-time governments. For example, in the State of Idaho, there are 199 incorporated cities, 179 (90 percent) of which have populations below 5,000 people. Of these 179 communities, only 7 have full-time city administrators. Many municipalities with populations under 5,000 have a city clerk as their only full-time employee. Mayors and city council members in the typical rural community receive little or no pay. Budgets are small and discretionary dollars are non-existent. These attributes of smaller, rural communities may make it difficult for them to withstand complex changes. This can lead local governments to rely more heavily for technical and financial assistance on higher levels of government (Harris et al. 1996).

Overview of Employment

A discussion of the contribution that agency lands make to economic growth and employment is included because growth and employment are affected by agency land use choices and are key elements of major public issues.

Regional Employment Status

The economy of the project area has undergone substantial change over the past three decades (Table 2-29). In terms of jobs, the project area has grown much faster than the nation as a whole. The number of jobs has increased even during periods when employment in manufacturing (other than instruments and electronics), mining, logging, farming, and ranching was either stagnant, falling, or moving erratically (Rasker 1995). Employment in service industries has increased substantially, and the number of households receiving "nonlabor income" (income from transfer payments, dividends, interests, and rents) has grown. Increases in service employment includes gains in recreation and tourism plus gains in business, education, management, and engineering services generated by new residents. Evidence of this change is shown in part by the 61 percent of job growth since 1969 in services, retail sales, and finance, insurance and real estate. Rapid employment growth is also found in advanced technology, retail trade, transportation services, and construction.

Much of this economic growth has been centered in metropolitan counties and counties experiencing rapid population growth. However, analyses that focus exclusively at regional levels, such as Rasker (1995), Niemi and Whitelaw (1995), and Power (1996), tell only part of the story. By focusing on the region as a whole, studies can overlook the significant differences between large cities and small rural communities in the region (Harris, Brown, and McLaughlin 1995), and even among small communities (Robison, et al. 1996) most affected by federal land management policies. Table 2-30 shows specific examples of differences among regions at the RAC/PAC level, where employment percentages in some

Table 2-29. Employment By Industry in the Project Area.[1]

Item	1969	1992	% Change 1969-1992	1996	% Change 1992-1996
Total Employment	908,954	1,619,923	78.2	1,921,147	18.6
Farm and Ranch Employment	120,504	112,264	-6.8	126,867	13.0
Nonfarm Employment[2]	788,450	1,507,659	91.2	1,794,280	19.0
Agriculture Services, Forestry, Fisheries	9,308	35,208	278.3	44,591	26.7
Mining	8,590	10,372	20.7	11,381	9.7
Construction	42,243	81,929	93.9	117,024	42.8
Manufacturing	119,703	176,067	47.1	197,397	12.1
Transportation, Communications and Utilities	44,931	67,304	49.8	75,925	12.8
Wholesale Trade	38,110	72,826	91.1	81,301	11.6
Retail Trade	141,661	279,555	97.3	340,554	21.8
Finance, Insurance and Real Estate	51,879	90,684	74.8	102,279	12.8
Services	153,587	411,911	168.2	509,914	23.8
Federal Government (Civilian)	29,178	37,965	30.1	36,926	-2.7
Military	28,188	25,391	9.9	23,368	-8.0
State and Local Government	116,924	206,629	76.7	236,765	14.6

[1] Employment data are for the project area as described in the original Draft EISs. They include data for the relatively sparsely populated areas in Wyoming, Utah, Nevada, and along the eastern side of the Cascade Crest in Washington and Oregon that are not included as part of the decision space for the Supplemental Draft EIS.

[2] Note that the sum of the individual sectors add up to somewhat less than total Nonfarm Employment because of employment data disclosure restrictions or other data limitations at the county level within a sector. Numbers not included for specific sectors for these reasons, however, are included in the next broader category.

Source: Bureau of Economic Analysis, Regional Economic Information System (CDROM)

RAC/PACs are higher than the project area as a whole and/or U.S. averages (for example, Southeastern Oregon RAC for agricultural services; Upper Columbia-Salmon/Clearwater R4 RAC for mining).

At the community level, Reyna (1998) examined the economic specialization in mining, agriculture, and wood products manufacturing of 411 communities in the project area. Economic specialization was measured by comparing a community's employment in those economic sectors with employment in the same sectors for the larger economic (BEA) subregion in which the community lies. If the community's employment percentage in a sector was greater than that for its BEA area, it was considered to be economically specialized in that sector. He found 49 communities with economic specialization in mining (30 high to very high); 266 communities economically specialized in agriculture, which includes livestock production and grazing (123 high to very high); and 137 communities with economic specialization in wood products manufacturing (85 high to very high).

Employment Associated with Forest Service- or BLM-administered Lands

Direct employment generated from Forest Service- or BLM-administered lands falls mostly into job categories such as manufacturing (especially wood products), agriculture (especially livestock grazing), agricultural services (including forestry services), mining, and federal employment. Another employment sector affected by agency land use is recreation and tourism, although this is not a formalized economic sector and does not have directly measurable employment data. Rather, direct employment related to recreation and tourism is found primarily in various components of the retail trade and services sectors.

Together, these employment categories are the ones most likely to be affected as a result of changing federal land uses. Currently, about 95,000 jobs are associated with livestock grazing, recreation, and timber harvest on lands administered by the Forest

Table 2-30. Employment in Economic Sectors of the United States, Percent by Sector, RAC/PACs and the Basin[1],1996.

Industry	United States	Basin Average[1]	Butte RAC	Klamath PAC	Deschutes PAC	John Day Snake RAC	South Eastern Oregon RAC	Lower Snake River RAC	Upper Snake River RAC	Upper Columbia Salmon-Clearwater R1 RAC	Eastern Washington RAC	Yakima PAC	Eastern Washington Cascades PAC	Upper Columbia Salmon-Clearwater R4 RAC
Agriculture services	1.24	**2.20**	**1.67**	**2.37**	**1.81**	**2.76**	**4.23**	**2.14**	**3.39**	**2.28**	**1.82**	**3.34**	**4.77**	**1.40**
Mining	0.58	**0.59**	0.47	0.10	0.12	0.04	0.34	0.23	0.41	**2.01**	0.15	0.06	0.19	**0.74**
Construction	5.33	**6.09**	**6.93**	**5.67**	**7.18**	3.98	3.85	**7.63**	**6.55**	**7.92**	**5.46**	**4.45**	**5.57**	**7.38**
Manufacturing	12.63	10.27	9.07	13.68	12.01	11.39	9.99	13.87	8.75	7.79	9.53	8.68	6.59	12.22
SIC 24[2]	0.57[3]	2.00	3.44	8.58	5.69	2.39	3.22	1.99	0.31	2.84	0.94	1.17	1.15	4.58
Transportation	4.73	3.95	**4.99**	4.01	3.08	4.03	4.10	4.31	4.37	3.36	3.70	3.41	2.78	3.83
Trade	21.48	**21.96**	**23.03**	**22.39**	**22.85**	19.69	**21.97**	21.39	**23.40**	20.16	**22.07**	**21.59**	**22.74**	**23.00**
FIRE[4]	7.41	5.32	5.93	4.70	5.58	4.05	3.35	6.30	4.20	5.41	6.21	4.35	5.44	5.62
Services	30.44	26.54	**30.46**	25.65	27.61	24.38	20.08	26.64	25.77	19.17	26.44	27.96	22.26	25.53
Government (all)	14.24	**15.46**	**14.34**	**15.17**	12.36	**17.62**	**16.98**	**13.90**	**14.42**	**20.53**	**16.97**	14.20	**14.93**	**17.07**
State and local	10.88	**12.32**	**11.05**	**11.69**	9.88	**14.35**	**13.51**	10.02	**12.11**	**11.80**	**13.28**	**12.08**	**12.34**	**14.31**
Farm employment	1.93	**6.56**	**2.99**	**6.21**	**5.45**	**10.46**	**14.44**	**3.39**	**8.38**	**6.15**	**6.66**	**11.72**	**14.55**	**2.73**

Bold - Values above the national average.
[1] Numbers are for the entire interior Columbia River Basin assessment area.
[2] SIC 24 - Standard Industrial Classification for lumber and wood products. Manufacturing number includes SIC 24.
[3] National SIC 24 figure from 1990 data (Beuter 1996).
[4] FIRE - Finance, insurance, and real estate.

Abbreviations used in this table:
RAC - Resource Advisory Council
PAC - Provincial Advisory Committee
R1 - Forest Service Northern Region
R4 - Forest Service Intermountain Region
SIC - Standard Industrial Classification

Service or BLM in the project area. It was estimated that recreation accounts for 81 percent of these jobs, timber harvest for 9 percent, livestock grazing for 1 percent, and various forestry services (silviculture, thinning, planting, etc.) for the remaining 8 percent (Crone and Haynes 1999).

Employment data by county and other county data can be found in Appendix 7.

Manufacturing

Manufacturing jobs overall make up a smaller percentage of total employment in the project area than they do nationally, suggesting that the area is not comparatively strong in manufacturing. However, this is not the case for the wood products component of manufacturing. Wood products manufacturing, a job category closely tied to federal timber harvest, falls under the general manufacturing sector and is still perceived by many to dictate the economic health of the overall regional economy. This view is no longer accurate at the project area, economic (BEA) subregion, or in most cases, the RAC/PAC level. The reduced regional importance of wood products manufacturing is due more to rapid growth in other sectors of the economy than to declines in the wood products industry.

Although no longer dictating overall economic health of the region, wood products manufacturing employment is still above the national average in much of the project area and is locally important to a number of communities. For the project area as a whole, and for 11of 12 RAC/PACs, wood products manufacturing is a proportionally larger part of total employment in the project area than it is nationally. While the latest national percentage available is 0.57 percent (Haynes and Horne 1997; Crone and Haynes 1999), the project area average in 1996 was 2 percent. The highest project area percentage, as of 1996, was found in the Klamath PAC at 8.6 percent, while the lowest percentage is in the Upper Snake River RAC, which is just over 0.3 percent. As mentioned earlier, Reyna (1998) found 85 individual communities that are highly to very highly specialized in wood products manufacturing.

As detailed below, timber industry employment (related to timber harvest from all ownerships) in the project area over the past two decades has followed a pattern similar to other areas of the western United States. Employment reached a peak in 1979 with historically high timber harvest levels, then declined during the recession of the early 1980s. Employment climbed again to another high point around 1989–1990, following another peak in timber harvest levels.

Although no longer the regional economic driver that it once was, wood products manufacturing employment is still proportionally above the national average in much of the project area, and is locally important to a number of communitites.

But total employment did not climb to the same levels reached a decade earlier, primarily because of technological advances in harvesting and processing methods. (This trend toward fewer jobs per volume of wood processed was more pronounced in the Idaho and Montana portions of the project area than in eastern Washington and eastern Oregon during that period.)

Between 1978 and 1982, timber industry employment in Idaho and Montana dropped from nearly 28,000 to just over 18,000. It then climbed back to almost 22,000 by 1990, before beginning another decline by 1993. In eastern Oregon/eastern Washington, timber industry employment dropped from an estimated 24,000 in 1978 to about 16,500 in 1982. In then climbed back to about 23,000 by 1990, before beginning to decline again by 1993. Between 1990 and 1996, timber industry employment for the entire project area declined from nearly 45,000 to about 38,500.

Reductions in employment were due to several factors, including the recession of 1990, legally imposed reductions on federal timber sales, technological improvements in harvesting and milling, and changes in the mix of products manufactured by the region's timber industry. Changes in milling technology and competitive product marketing are longer-run forces gradually reducing the industry's employment per unit of wood product produced.

Employment in the pulp and paper manufacturing sector is acknowledged but not dealt with in detail in this EIS. This is not to suggest that there will be no effects in the pulp and paper employment sector, but rather suggests that this sector will respond differently to supply-induced changes than the solid wood products sector.

The pulp and paper manufacturing sector consists of pulp processing, paper processing, and paper converting (such as envelope and bag manufacturing). The pulp sector is most likely to be affected by changes in forestry activity, but low prices from a huge supply of pulp on the global open market, utilization of alternate supply sources and species, and improved pulp recovery processes can allow

these industries to maintain installed capacities (FEMAT 1993). Therefore, Forest Service and BLM policies and associated effects on timber harvest in the project area are not expected to have significant direct impacts on pulp and paper manufacturing employment in the project area. This is not to suggest there will be no impacts on the pulp and paper industry, but that the industry will respond to supply (and changes) differently than the solid wood products sector.

Agricultural Services and Farm Employment

Unlike the manufacturing group overall, the agricultural services group has a higher percentage of total employment in the project area than nationally (approximately 2.3 percent in the project area vs. 1.2 percent nationally), showing the comparative economic importance of this employment. Individually, all RAC/PACs show an employment percentage higher than national levels. The highest percentages of employment in agricultural services for the project area are in the Eastern Washington Cascades RAC and the Southeastern Oregon RAC, with 4.8 percent and 4.2 percent respectively.

Farm employment for the project area is significantly higher than the national average—about 7 percent compared to the national average of 1.9 percent. As with agricultural services, farm employment is greatest in the Eastern Washington Cascades RAC and the Southeastern Oregon RAC, with 14.6 percent and 14.4 percent respectively.

Mineral Resources

The mineral industry generally provides somewhat less employment in the project area than the national average (less than 0.5 percent vs. 0.6 percent). All of the RAC/PACs, with the exception of the Upper Columbia-Salmon/Clearwater-R4 RAC (2.0 percent) and the Upper Columbia-Salmon/Clearwater-R1 RAC (0.7 percent) fall below both the regional and national averages in minerals-related employment.

As noted earlier, Reyna (1998) found 49 communities in 32 counties (33 communities in 19 counties just in Idaho) that have an economic specialization in mining. Mining is important to jobs, income, and infrastructure in and around those communities.

Forest Service and BLM Employment

Federal employment associated with Forest Service or BLM administration of public lands can be important locally, both in terms of job numbers and wages per job. This importance results from agency policy, particularly with the Forest Service, to locate administrative units in small, rural communities. The estimated 9,000 to 10,000 jobs in the project area may not be substantial regionally, but on a local basis, several dozen to a hundred or more jobs are very important to the vitality of these individual rural communities. Wages and salaries of federal employees stationed in rural communities in the region, and purchases of goods and services from local businesses to support the offices, also contribute to local economies.

In addition to contributing to local governmental revenues or economic activity in rural counties, the BLM and the Forest Service both have programs that result in direct spending within their jurisdictional areas. This money contributes to economic activity in rural settings. The two agencies spend millions of dollars annually for supplies and contract services to support their range, recreation, timber, fire management, and minerals programs, as well as for maintenance of roads and facilities (estimates of this spending are discussed in the "Implementation Costs" section).

Recreation

Recreation-based employment, while not directly measured by the Bureau of Economic Analysis as a separate industry, is estimated to generate approximately 4.5 percent of employment in the project area (Crone and Haynes in press and 1999). This is slightly larger than the estimated combined percentage (3.5 percent) of all jobs associated with ranching, mining, and lumber and wood products manufacturing in the project area. Recreation-related employment must be estimated from the proportion of other industry group employment that supports recreation; for example, amusement, retail, lodging, eating and drinking, and gas stations.

Project area-wide recreation on Forest Service- and BLM-administered lands within the project area supports an estimated 77,000 jobs (Crone and Haynes in press and 1999). A regional economic study conducted by the Forest Service in the central Rocky Mountains recognized the export nature of some tourist-related service industries. The effect of these service/tourist industries on the local economy was found to be similar to the earnings returned to a local firm from the export of physical commodities (DeVilbiss 1992).

Communities

As discussed early in this section, this EIS uses RAC/PAC areas as the base level of display for all estimated biophysical and socio-economic effects. However, a RAC/PAC area is very broad scale and is delineated along physical and hydrographic lines, rather than social/economic/political boundaries. While there may be some correlation between the two, transportation and trade routes and locations of large vs. small communities play the greater role in peoples' social and economic lives and interactions with others. For American Indians, the administrative designation of reservation boundaries, which also do not often follow physical and hydrographic features, has played an enormous role in their social, economic, and political lives over the past century. Therefore, in addition to the RAC/PAC level, socio-economic attributes and conditions will also be discussed in relation to counties, larger trade centers, and rural and tribal communities. The juxtaposition of the 92 counties in the project area with the RAC/PAC areas are shown on Map 2-29.

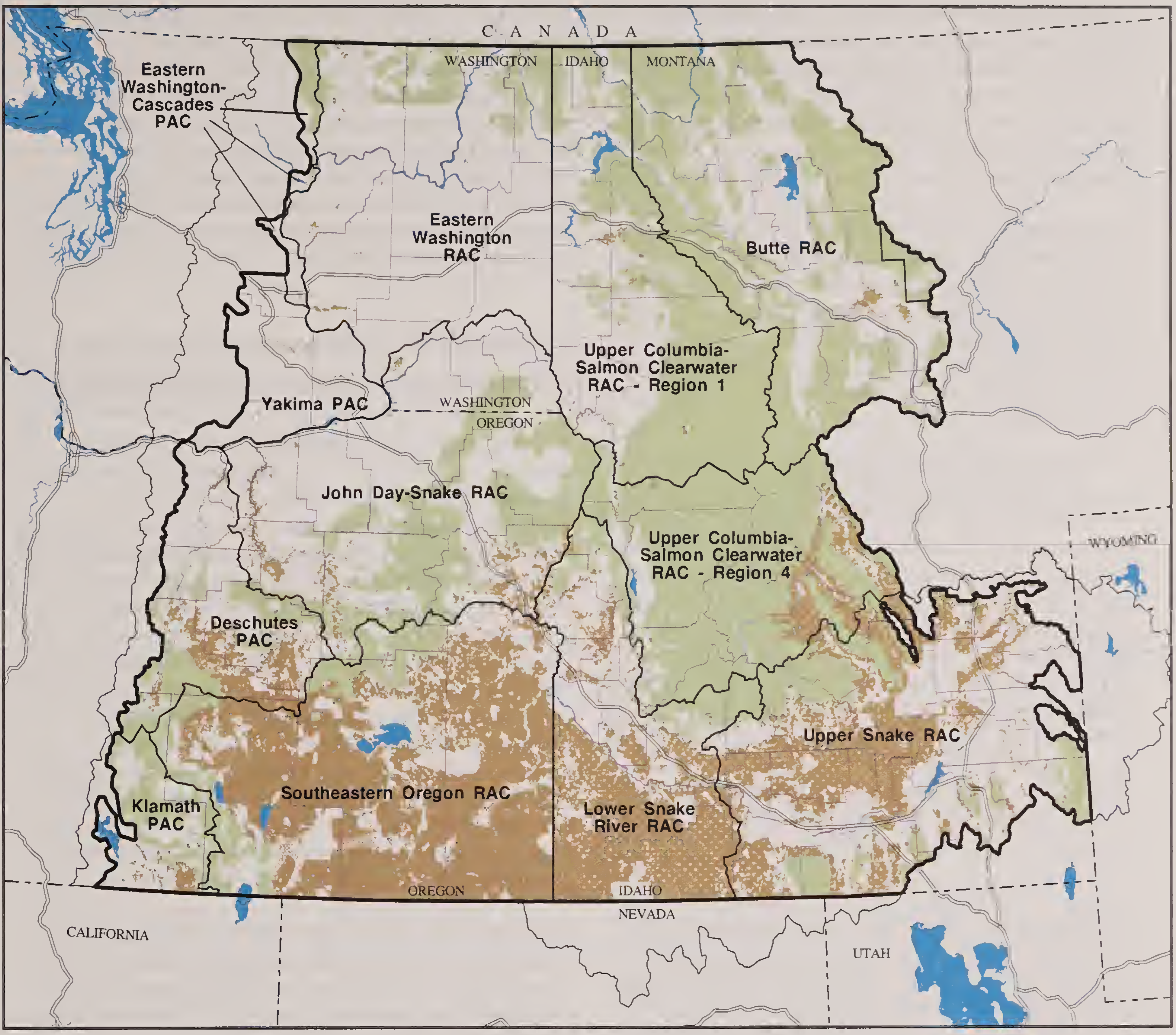
Smaller rural and tribal communities are of particular focus in this discussion. These communities, as a whole, are more subject to potential effects from various external forces: national and international market fluctuations; changing technology and transportation modes; population fluxes; and changes in historical land use policies, such as those currently being examined by the BLM and Forest Service. The well-being of rural communities that are economically or socially connected to Forest Service- or BLM-administered lands has historically been an important, perhaps dominant, factor driving the social policies of these agencies. An understanding of the relationship between agency policy, land-use choices, and rural communities is a valuable component of the affected environment. Concern about the future of rural and tribal communities, especially those with higher than average employment in industries that rely on management of resources on Forest Service- and BLM-administered lands, has been strongly expressed from many sources throughout the project area during the ICBEMP process.

Within the project area, there are 12 RAC/PAC areas, which encompass fairly large pieces of the landscape (see Map 2-1, in the Introduction to this chapter). At a smaller scale, are all or part of 92 counties: 42 in Idaho, 12 in northwestern Montana, 18 in eastern Oregon, and 20 in Washington east of the Cascades (see Maps 2-24 and 2-29).

In 1998, responding to a congressional request for additional community-level information in the project area, the ICBEMP staff prepared a report (Reyna 1998) analyzing a total of 543 communities (511 of which are in the revised project area boundaries). The report provided information about the relative status of communities as major regional trade centers, isolated trade centers, or geographically isolated communities. It provided 1992 population figures for most of the communities, including a number of very small communities not officially tracked by the Census Bureau, and described the communities' proximity to Forest Service- and BLM-administered lands and to American Indian reservations. Reyna then used the employment data collected by Harris et al. (1996) to characterize the economic specialization of each community in 12 economic sectors. (Specialization in the "recreation sector" could not be computed, because economic activity related to recreation is spread among the trade and services sectors

Human Communities

The term community has several definitions, sometimes referring to ecological plant and animal communities and sometimes referring specifically to human communities. Human communities can be groups of like-minded people who gain strength from their relationships and associations. "Communities of interest" are people employed in a similar profession, people who participate in the same activities, or those who share a set of values—for example, the "ranching community" or the "environmental community." As used in this section, the term community has a more traditional definition: spatially-defined places such as towns. The community is where people socialize, work, shop, and raise their children; it is often the focus of their social lives. Counties are an important political scale to consider, but leaving the discussion at that level would mask many differences among communities within a given county. See the Glossary for additional definitions related to ecological communities.



Map 2-29. RAC/PAC Areas and Counties

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[lodging, food, service stations, recreation supplies, and the like], and is not tracked directly by the Bureau of Economic Analysis or other statistical agencies.) The tables from the Reyna (1998) report showing community attributes, as well as the calculations of economic specialization by economic sector for each community, are reproduced in Appendix 7.

The Bureau of Census recognizes and tracks 471 of the 511 communities listed in the (1998) within the boundaries of the revised project area (Map 2-30). Of these, 418 are classified as incorporated places and 53 are Census-Designated Places - areas of population concentration that are unincorporated but have an identity to the local population (USDC Census Bureau, 1992).

As of July 1, 1998, there were 42 communities, including four Census-Designated Places, with populations of 10,000 or higher (USDC Census Bureau, 1999-a). Approximately 32 communities (including 10 Census-Designated Places) have between 5,000 and 10,000 people. Twenty more Census-Designated Places are geographically closely associated with larger towns and trade centers (essentially unincorporated suburbs or nearby unincorporated settlements). Of the roughly 380 other smaller rural (including tribal) communities tracked by the Bureau of Census, approximately 75% are communities of 1,500 or fewer people, and 44% are communities of fewer that 500 people. The smallest communities still tracked by the Bureau of Census range down to fewer than a dozen people.

Of the 511 communities listed by Reyna (1998), 64 communities are located on or near American Indian reservations (Map 2-31). A few of these are large trade centers that are close to reservations, but would not be considered "tribal communities" — Pocatello and Lewiston, Idaho; Pendleton, Oregon; and Yakima, Washington. Other smaller towns, such as Omak, Zillah, and Sunnyside, Washington; Madras, Oregon; and Blackfoot, Idaho, are on the periphery of reservation lands but are more mixed cultural, economic, and trading centers along major transportation routes. All but 3 of the 64 communities are tracked either as incorporated places or CDPs by the Census Bureau. Thirteen CDPs are associated with reservations, such as Fort Hall CDP on the Fort Hall Reservation (Shoshone–Bannock tribes) and White Swan CDP in the Yakama Nation. Of the 61 communities on or near Indian reservations that are tracked by Census, about 55 percent have populations of 1,000 or less, and 39 percent have fewer than 500 people. Population density of many of the CDPs is quite low, because the CDPs cover a fairly large geographical area.

For the Interior Columbia Basin Ecosystem Management Project, many types of information about communities in the project area were collected. Harris et al. (1996) contains a complete description of this information, which included Community Self-Assessments — interviews with 1,350 community leaders and residents in nearly half (198 out of 476) of the (original) project area's communities. Profiles of the economic structure of each community were developed (Robison, as cited in Harris et al. 1996). These will be valuable sources of information for the Forest Service and BLM to use in future planning, and for communities themselves.

Community Stability and Community Dependency on Resource Availability

Various concepts of community stability, resource dependency, and even flow/sustained yield of resource outputs — particularly timber — have for years dominated discussions of local community economic and social impacts from changing federal land management policies. Both the Eastside and UCRB Draft EISs discussed these issues at length. However, those concepts are of a relatively static, or "fixed in time," nature, and have not been particularly useful in recognizing the multitude of external forces that affect the well-being of communities, or in describing the potential ability of communities to adapt, or respond in a positive way, to those changes. (Readers who wish to review these issues and related discussion are referred to the original Draft EISs: pages 2-194 to 2-201 in the Eastside Draft EIS, and pages 2-191 to 2-195 in the UCRB Draft EIS.)

The Draft EISs did take the attributes underlying the basic notions of community stability and resource dependency a step further, developing county-level "timber/forage importance indices." These indices were developed by first measuring the status of factors such as percent federal land in the county, percent timber harvest or range production coming from federal lands in the county, population change over the past 12 to 15 years, federal revenue-sharing payments as a percent of county budget, economic diversity ratings, percent of total county employment in natural resource-related sectors, and recreation visits to national forests. These factors were scored and then summed to create index ratings of low, medium low, medium high, and high.

The "timber/forage importance" index ratings gave an indication of the importance of federal lands and use of resources from federal lands to the overall socio-economic status of each county. The measured attributes are in and of themselves of interest, and help to understand the current levels and intensities of county economic interactions with federal lands and resources produced

from federal lands. However, the indices that were developed did not prove to be as useful as desired for assessing the ability of counties and communities to adapt to change—in particular to changes from re-direction of federal land use policies and related management actions in the project area. (The attributes used for developing the "timber/ forage importance" indices in the Draft EISs are reproduced in Appendix 7 as part of the descriptive county-level information included with this Supplemental Draft EIS.)

Community and Socio-economic Resiliency

Community Resiliency

Recently, many social scientists documenting challenges facing rural communities throughout the country have concluded that stability is not the only way to achieve the broader goal of prosperous, vital communities. Community resiliency—the ability to successfully deal with the inevitable multiple social and economic changes that are evident in our society—is one of the most important indicators of a community's health and vitality. Focusing on resiliency, and the components that increase or decrease resiliency, is also very useful when economic development agencies and similar parties are developing programs of assistance to help communities improve their vitality and prosperity and increase their ability to adapt to current and future changes. Harris et al. (1996) described resiliency as consisting of population size, economic strength and diversity, attractiveness and surrounding amenities, strong leadership, and other factors such as community residents' ability to work together and be proactive toward change. This definition of resiliency is similar to the concept of community capacity that evolved during the development of the Northwest Forest Plan (FEMAT 1993).

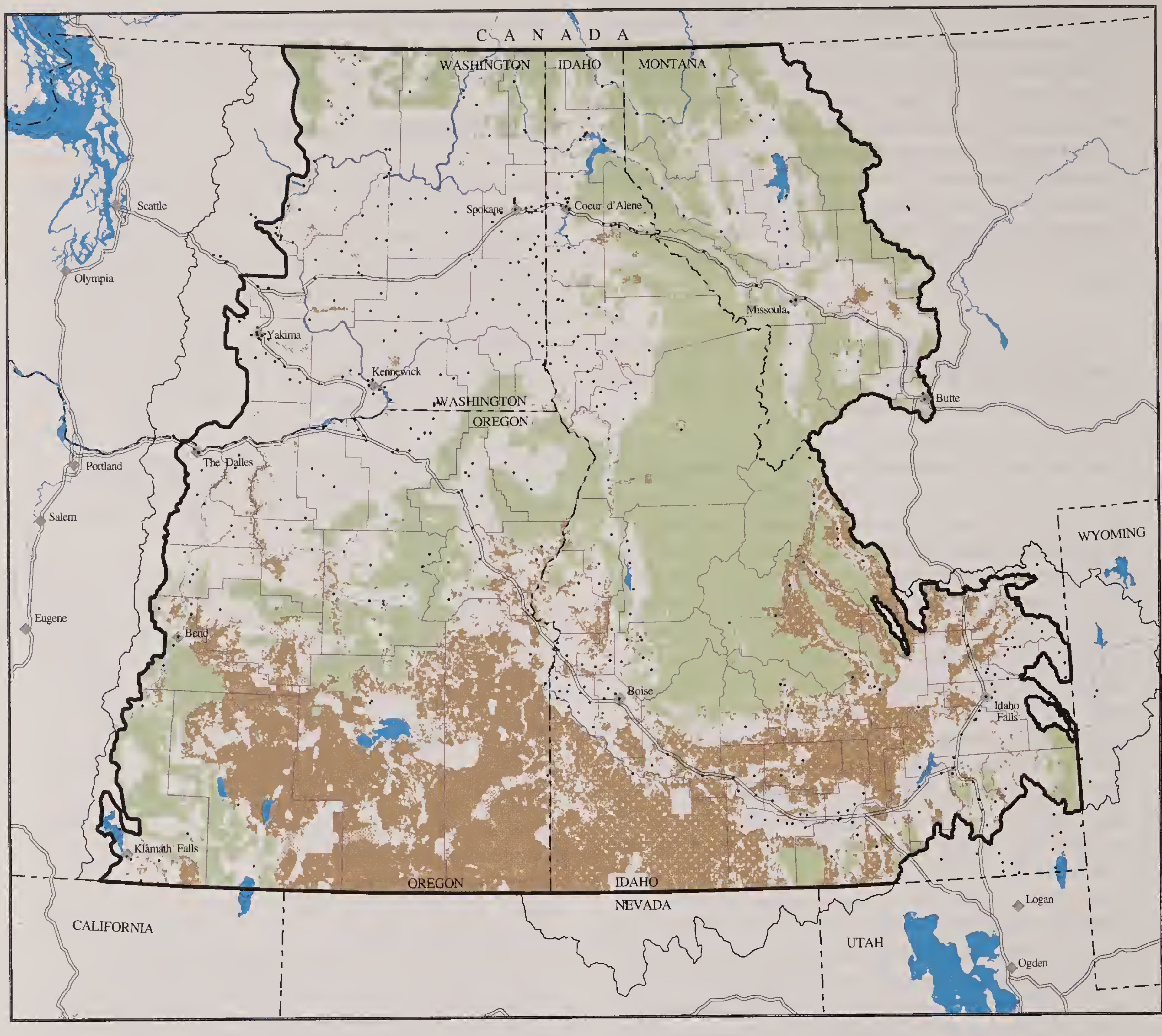
Harris et al. (1996) used the Community Self-Assessment information to develop a relative scale of community resiliency for rural communities of fewer than 10,000 people in the project area, to measure how well-equipped communities are to deal with change. The most resilient communities tended to be larger in population, have an economy based on a mix of industries, view themselves as autonomous, and have worked as a community to develop strategies for the future. Many communities are beginning to work together to identify ways of capitalizing on their location and other characteristics to cope with the many changes affecting their health and vitality. (See the Draft EISs for a more thorough discussion of the various components of diversity and of community social and cultural attributes that Harris et al. [1996] derived as components of community resiliency from their survey work in project area communities.)

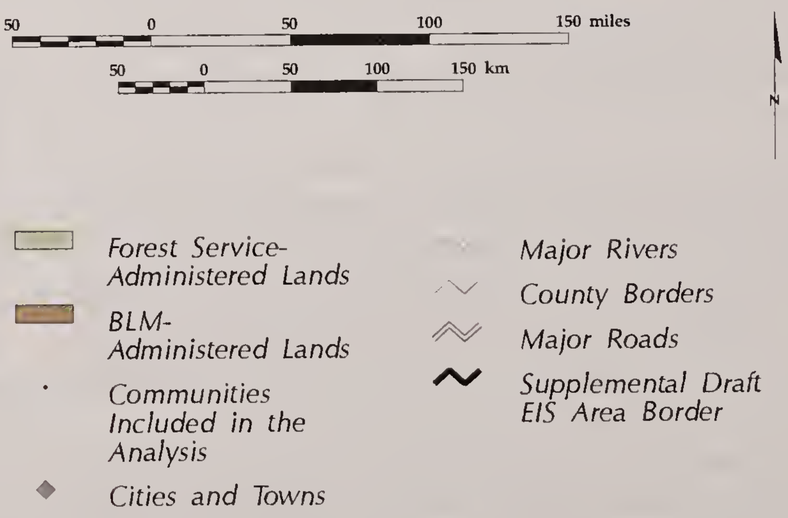
Socio-economic Resiliency

Following Harris et al. (1996), as well as similar work by other social scientists, McCool et al. (1997) developed a theoretical framework for socio-economic resiliency that focused on five factors: population size (which may tend to increase skill mix and social and cultural diversity); economic diversity; civic infrastructure (leadership, positive outlook, and social cohesion); amenities (both natural and human-made, such as libraries, arts, and the like); and location (both in the biophysical environment and relative to other communities, growth centers, and the like). However, they did not provide actual measures or examples of these factors or their integration into a resiliency measure.

More recently, Horne and Haynes (1999) developed a measure of socio-economic resiliency, which they felt could be useful for understanding the extent to which changing federal land use policies may affect social and economic systems within the project area. They wanted a measure that was quantifiable and that contained good proxies for a more complex set of variables, such as those used by Harris et al. (1996) or proposed by McCool et al. (1997). Looking at these works, as well as other research done, they propose a socio-economic resiliency measure based on three factors: economic diversity or resiliency, population density, and lifestyle diversity. Data exist to quantify each of the factors, and a process was developed to score and combine the results into socio-economic resiliency ratings. They applied this process to the counties within the Interior Columbia Basin project area and provided tabular and mapped results.

As can be seen in Map 2-32, high-resiliency ratings (based on the Horne and Haynes process) tend to lie along major transportation corridors (Interstates 82, 84, 86, and 90; the Columbia-Snake River waterway to Lewiston, Idaho). A second group of counties with high resiliency is associated with areas having high scenic amenities and quality of life along the east slope of the Cascade Range and the northern Rocky Mountains. The metropolitan areas are really multi-county complexes linked by trading and commuting patterns. Areas with medium socio-economic resiliency tend to connect or fill in areas of high resiliency. In contrast, large expanses of areas with low socio-economic resiliency are found in the arid parts of the project area—eastern Oregon and southern Idaho, as well as the more rugged and isolated portions of central Idaho, western Montana, and eastern Washington (Horne and Haynes 1999).





Map 2-30.
Communities Included in the Analysis

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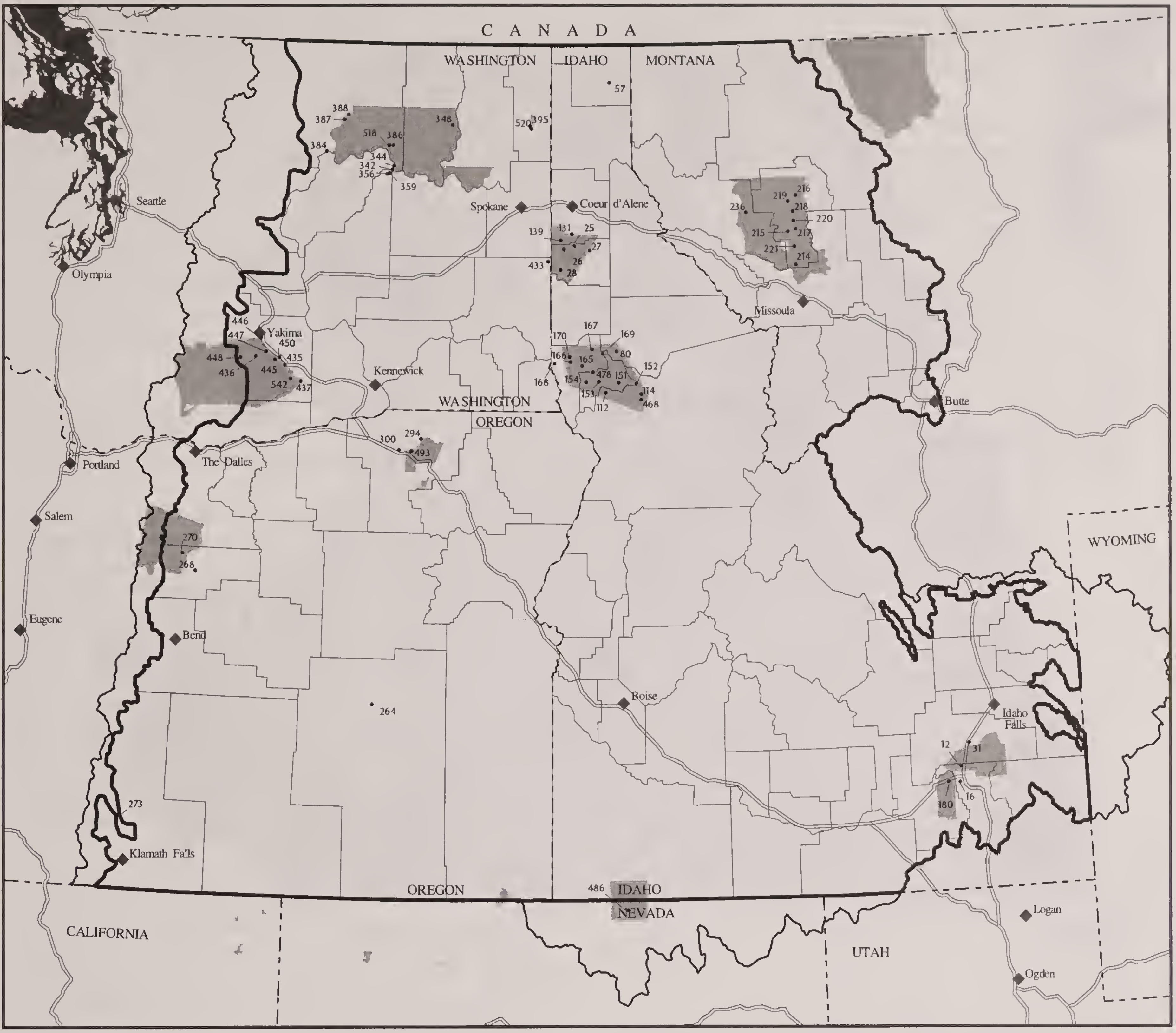

Map 2-31. Communities Associated with American Indian Reservations

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50 0 50 100 150 miles

50 0 50 100 150 km

N

Reservations

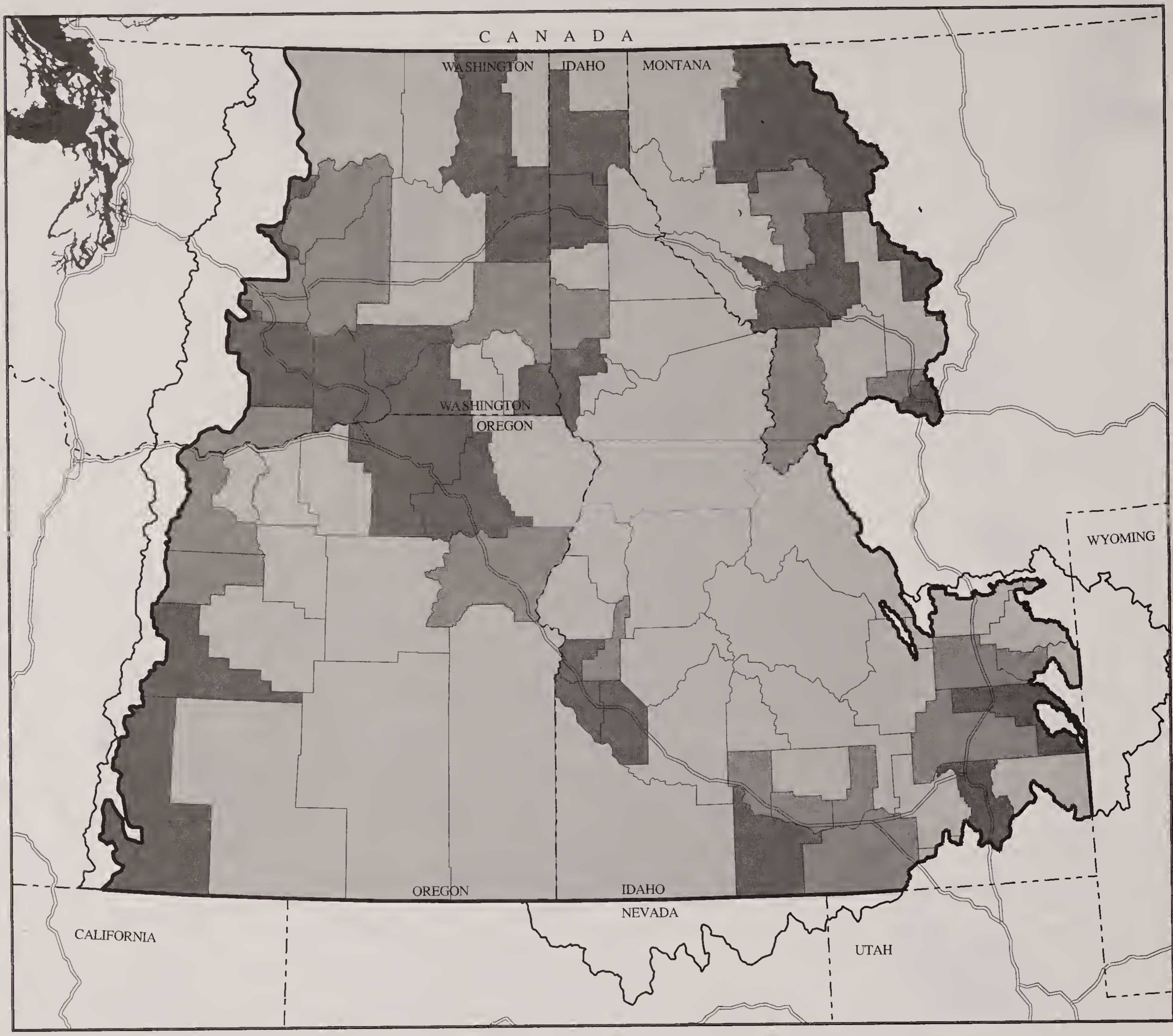
Communities Associated with American Indian Reservations

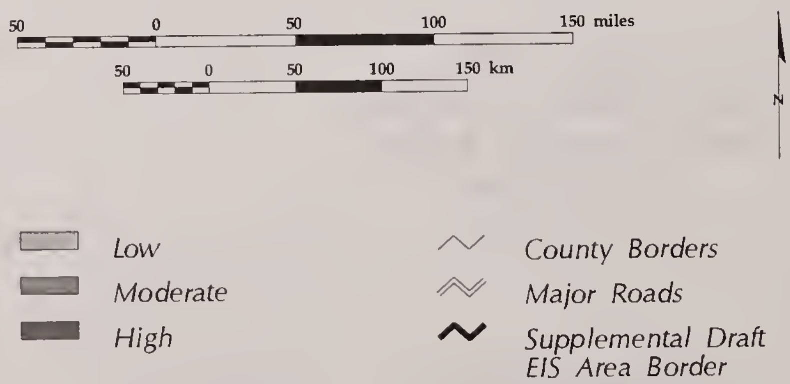
Cities and Towns

County Borders

Major Roads

Supplemental Draft EIS Area Border





Map 2-32. Socio-economic Resiliency Ratings

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Horne and Haynes (1999) are careful to explain that their results are not necessarily new or better (more "right") answers. Rather, the results are indicators of a complex of components that can influence the ability of communities, or groups of communities, to change and adapt to a variety of social and economic factors that are constantly in a state of flux. Their results provide additional information, along with that from other sources and analyses, to help land managers and the public understand the spatial patterns of the different responses economic and social systems may exhibit when faced with significant challenges (Horne and Haynes 1999).

Isolated and Economically Specialized Communities

As described earlier, Reyna (1998) examined geographic attributes for 511 communities in the original project area, and employment data for 411 of those communities. He identified trade centers; "not-isolated" towns within "city circles" around those trade centers; smaller "isolated trade centers" — towns with populations roughly between 2,000 and 9,000; and isolated towns — those outside the city circles and less than 2,000 population. He then calculated economic "specialization ratios" for each community, for each of 12 economic sectors: agriculture, agricultural services, mining, construction, trade, transportation, services, federal government, state and local government, wood products manufacturing, other manufacturing, and finance/insurance/real estate (FIRE). Reyna measured economic specialization by comparing a community's employment in each economic sector listed with employment in the same sector for the economic subregion in which the community lies. If the community's employment percentage in a sector was greater than that for its economic subregion, it was considered to be economically specialized in that sector. Specialization ratios were categorized as low, medium, high, and very high. The display of attributes by community and the results of the economic specialization calculations by community are displayed in Appendix 7.

The findings from the report indicate that isolated towns differ from not-isolated towns in terms of the degree to which they are economically specialized in different sectors, the amount of federal lands likely to be nearby, and the likelihood of having a BLM or Forest Service office located there. Findings also showed that specialization in isolated communities is most likely to be in the agriculture (crops and livestock), agricultural services, wood products manufacturing, mining, and federal government sectors.

A visual summary of the concentration of isolated and economically-specialized communities by subbasin within the project area is shown in Map 2-33.

While the Harris et al. (1996) and Horne and Haynes (1999) reports look specifically at various measures, both factual and perceptual, of community adaptability and resiliency, the Reyna (1998) report lays out some current economic attributes of a large number of communities in the project area, but it does not attempt to draw conclusions about community resiliency or adaptability. The findings of the report in terms of type and degree of economic specialization, along with other community attributes presented, are intended to be additional information for planners, policy-makers, and the public to use, along with other pertinent information, to address issues of economic concern arising from changing federal land use policies.

County and Community Information

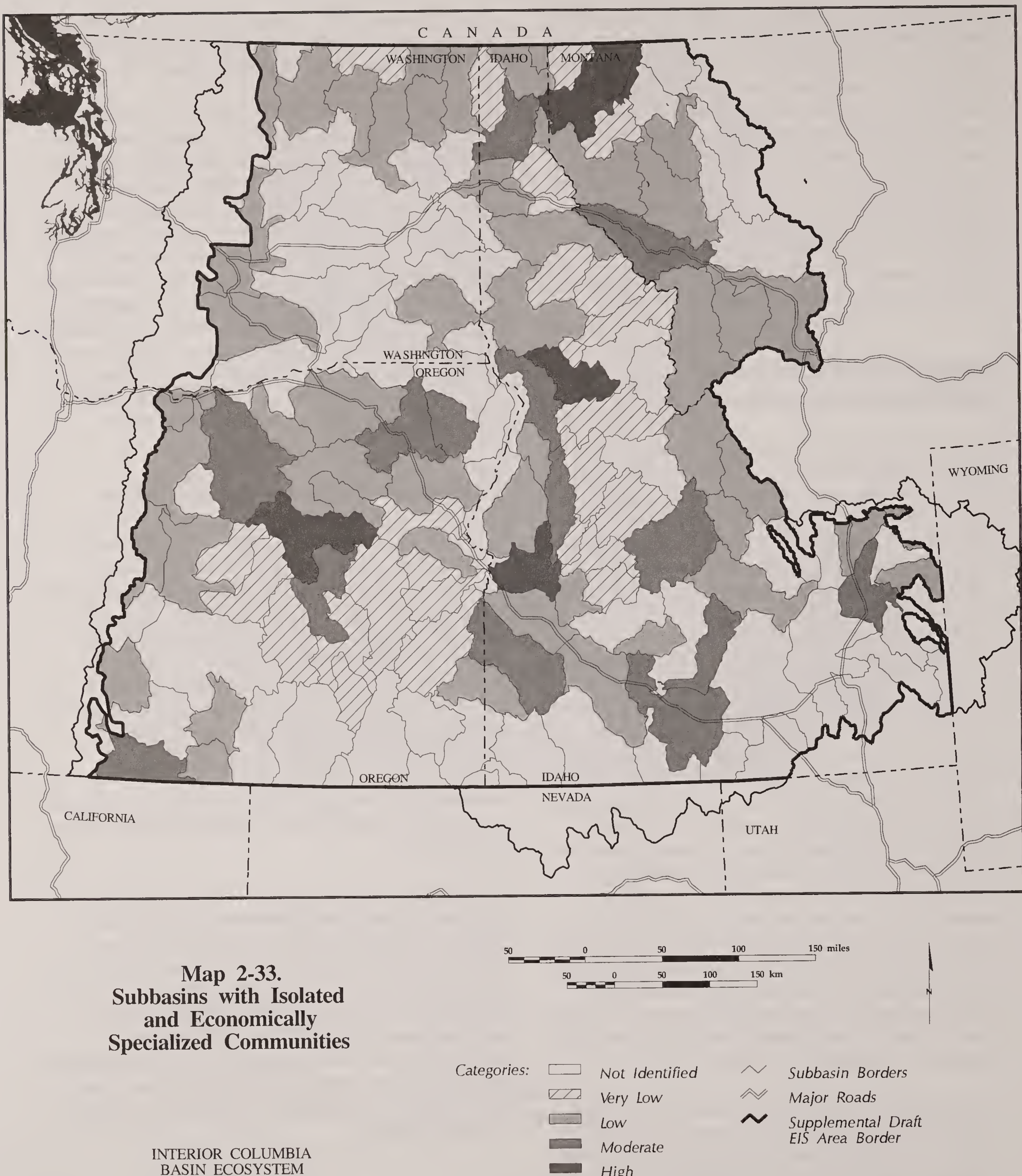
A variety of information is presented in Appendix 7 on the 92 counties in the project area, including employment and population data, per capita income, poverty levels, figures on federal timber and range production earlier in the decade, BLM- and Forest Service-administered lands as a percentage of the total county land base, and socio-economic resiliency ratings. This information provides context for socio-economic conditions within the basin at a scale broader than the community level.

Results from the Reyna (1998) report for communities within the project area are also reproduced in Appendix 7.

This information will help in the assessment of potential effects of the alternatives on communities or groups of communities. While community status within a county may vary widely among communities, the overall set of conditions at the county level, including some sense of socio-economic resiliency, helps indicate whether communities within the county that need more assistance are surrounded by a strong, or a not so strong, support structure (county government, social agencies, educational opportunities, and the like).

Attitudes, Beliefs, and Values

This section summarizes what is known about some public attitudes (favorable or unfavorable views of objects or events), beliefs (what people think is true),



Map 2-33. Subbasins with Isolated and Economically Specialized Communities

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and values (the things people hold dear to them) associated with ecosystem management. It is included in this chapter because not only have the physical, biological, social, and economic resources and opportunities in the project area changed, but people's perceptions of them have changed as well. Trends in these attitudes and values are important components of the social setting.

Environmental Issues

Dunlap and Scarce (1991) examined trends in attitudes toward environmental issues over the past 20 years, including issues such as threats posed by environmental problems, support for government actions, willingness to pay for environmental protection, perceived seriousness of environmental problems, and tradeoffs between environmental protection and economic development. They concluded that, as of 1991,

> *Public concern for environmental quality has reached an all-time high. While questions about the strength of environmental concern remains unclear, growing majorities see environmental problems as serious, worsening, and increasingly threatening to human well-being.*

Dunlap and Van Liere (1978) characterized these attitudes as rejecting the notion that nature exists solely for human use. Recent national surveys have found that a majority of the American public supports the environment and believes environmental issues should be a high social priority. A 1995 survey of Northwest residents (Harris and Associates 1995) found that 57 percent considered themselves an "environmentalist" while 41 percent did not.

However, support for environmental issues may be lower than it was several years ago, as more people question the costs of environmental protection. People today appear to be looking for a balance between restoration of natural processes and continued social and economic direct-use benefits. Most people believe such a solution is possible (Roper Starch 1994).

Support for endangered species laws and regulations is strong but may have decreased slightly in recent years. The public is increasingly concerned with seeking a balance between species protection and costs to society. A majority of Pacific Northwest residents support reauthorization of the Endangered Species Act yet believe it is only somewhat effective in protecting plants and animals (Harris and Associates 1995). Support for salmon recovery, and a willingness to accept resulting socio-economic impacts, seemed to be stronger than that for endangered species in general. However, most people perceive that the major barriers to recovery are dams and overfishing, rather than lack of suitable habitat.

Rural and Urban Perspectives

Survey research typically finds differences in opinions between residents of small, rural towns in the interior basin and residents of larger urban areas. National samples tend to be stronger on environmental protection, be less sympathetic to local economic impacts, and have greater trust in the Forest Service and environmental organizations than do local residents. For example, residents of small towns in the Pacific Northwest were less likely than city residents to favor strengthening the federal role in resource protection (Harris and Associates 1995). The same survey also showed a larger percentage of respondents from small towns and rural areas in Idaho, Oregon, and Washington, relative to their urban and suburban counterparts, believe that current government policies tend to favor the environment too much over jobs. When rural community leaders were asked, "what is the biggest problem facing rural communities," the most frequent response focused on the need for balancing the environment and the economy (McBeth 1995).

Citizens in rural communities have expressed the opinion that environmental and economic concerns must be balanced. For instance, in studies of more than 20 communities of southern and southeastern Idaho, respondents selected "air quality", "water quality", and "open spaces" as the three most satisfying aspects of their community life (Idaho State University 1990-1995). Conversely, respondents chose a "lack of employment opportunities" and a "lack of retail shopping" as the most dissatisfying features of rural life. The respondents' emphasis on the environment shows that the traditional sense of place and attachment to the land still plays the most significant role in rural life. Furthermore, the emphasis on employment opportunities is also rooted in the desire to preserve the community. Specifically, rural citizens largely desire increased employment opportunities so their children will be able to remain in the community.

Local Participation in Public Land Managment

Both locally and nationally, people believe that local residents and others most affected by public land management should participate and have a strong say in the outcome. The 1995 Harris poll, for example, found that support for increased environmental protection is significantly greater when state or local governments take the initiative than when the federal government does.

Biological Systems vs. Commodity Production

Another important change in societal values is the broader acceptance of viewpoints that emphasize natural biological systems over commodity production and other human uses (Steel et al. 1994). People with this philosophy were more likely to support bans on clearcutting, creation of wilderness areas, and protection of old-growth areas, while those people who emphasize human uses of ecosystem resources were more likely to set aside endangered species laws to preserve jobs or to give economic concerns a higher priority in forest decision making. Additional survey research conducted for this project showed a preference for the viewpoint emphasizing biological systems.

Sense of Place

Another type of value to be considered in ecosystem management is sense of place (Quigley and Arbelbide 1997; Galliano and Loeffler 1999). Forest Service- and BLM-administered lands in the project area contain many places that have special meaning to area residents, former residents, people whose forebears lived or worked in the area, visitors, and others living outside the area who may have a general appreciation that the basin, or certain areas within the basin such as the Columbia River, Hells Canyon, or River of No Return Wilderness, exist. Sense of place refers to how people define specific landscape locations based on their meanings and images. The importance of place as it is exemplified in American Indian culture is discussed later in this chapter. Areas such as historical mining areas, old railroad beds, ceded lands, Civilian Conservation Corps structures, or the presence of a nearby Japanese internment camp may have current or historical meaning to particular ethnic or minority groups.

Place assessment is a way to inventory the locations, names, and broad meanings of the attachments that people share for geographic areas. The concept of place has not been widely or uniformly used by federal land management agencies, either within or outside the project area. Specific areas, such as Hells Canyon National Recreation Area, have place assessments conducted for specific planning projects. The task of defining places has proven to be a positive process for involving community residents and stimulating discussion about common visions for public land management. The goal in such efforts was not to protect the places identified, or to allocate federal lands to one use or another based on them, but simply to have another source of information available when making resource management decisions.

Galliano and Loeffler (1999) (Williams 1995, Tuan 1974) recommended that, for the purpose of public land management, place assessment should occur at a community level, avoiding defining places that have meaning only to a few individuals or places that are so broad they have little meaning in a management context.

Federal Trust Responsibility and Tribal Rights and Interests

Introduction

American Indians have occupied the Columbia Basin for more than 12,000 years. By the time of European settlement, the interior Columbia River Basin was home to an estimated 50,000 American Indians. This section describes the specific cultural history and legal context for federal trust responsibilities and tribal rights and interests, and existing federal agency relations with the project area's affected American Indian tribes. It also provides more detail on major issues which tribes have indicated to be of specific concern to them, which are also summarized in Chapter 1. For a brief overview of the first settlers of the region, see the *Humans and Land Management: Snapshots in Time* section earlier in this document. For additional background information on American Indian tribes, see Appendix 8.

American Indian uses of Forest Service- or BLM-administered lands are greatly influenced by their cultural, social, economic, religious, and governmental interests and treaty-reserved rights. The U.S. government has a unique responsibility to Indian tribes with regard to tribal rights and interests (discussed in more detail later in this section), which is relevant to decisions to be made through this project relative to ecosystem-based management in the project area. The condition and status of many resources of interest and concern to tribes are described earlier in this chapter in the sections on landscape health, terrestrial source habitats, terrestrial and aquatic species, and aquatic/riparian/hydrologic resources. Additional information on social and economic considerations that affect American Indian tribes is found in the preceding socio-economic section.

Cultures

Culture is the whole set of learned behavior patterns common to a group of people, their interactive behavior systems, and their material goods. People rely on their culture to live, to relate to others as collective groups, and to understand and function in their world. A culture includes religious, economic, political, communication, and kinship systems. Together these elements of culture guide group behaviors and instruct members of the group. A culture area is an area where groups of people and their cultures, in this case American Indian tribes or bands, share similar cultural traits and networks.

Most of the prehistoric cultures of the project area belonged to either the Plateau or Northern Great Basin culture areas. The Pit River and Shasta tribes, who are associated with the Klamath Tribe, are grouped within the Californian Culture Area. More than 30 plateau bands historically occupied the northern portion of the interior Columbia River Basin and part of the Klamath Basin. Many bands, including the Bannock, Northern Paiute, and Shoshoni, occupied most of the project area's southern half.

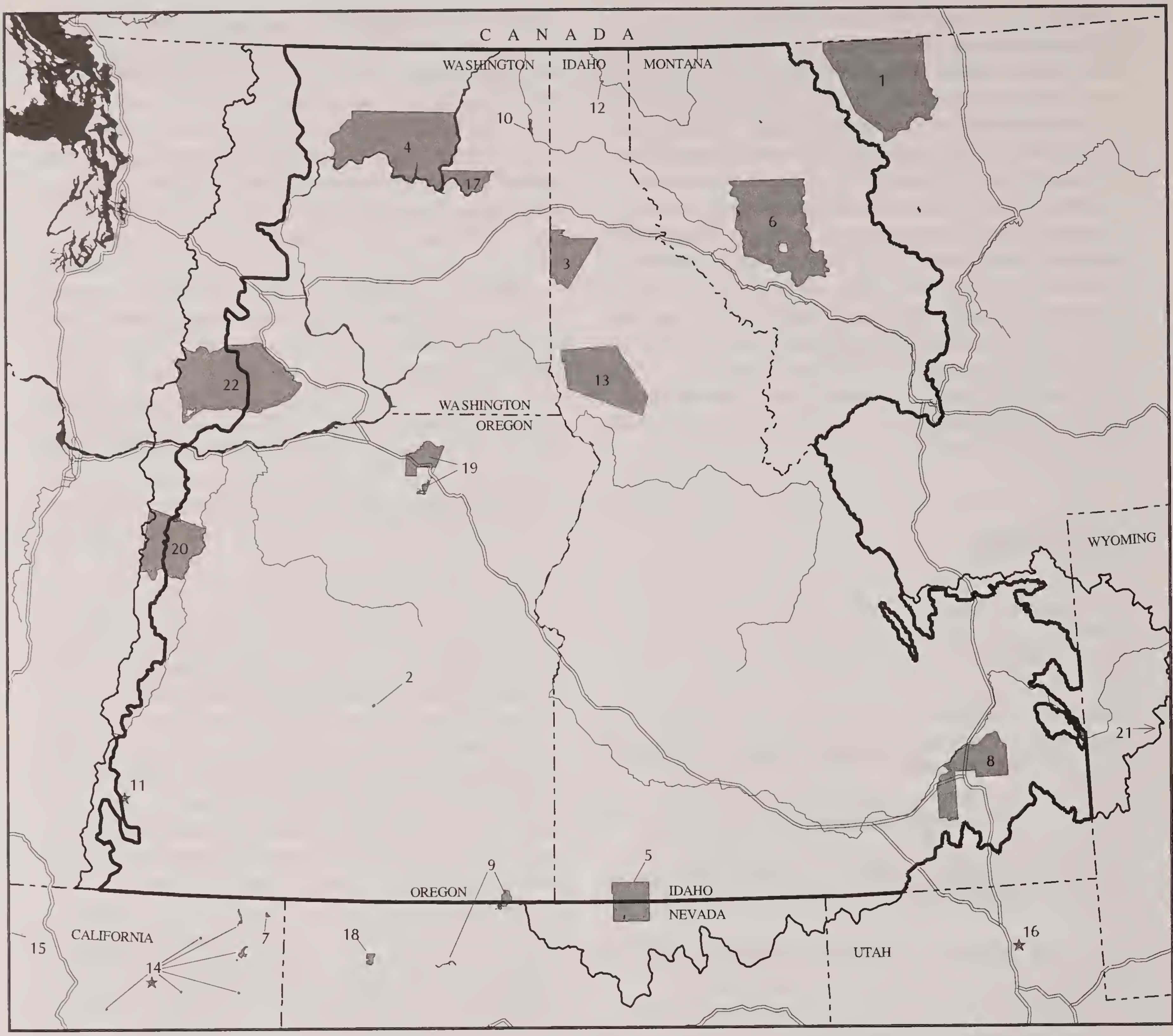
Differences existed among cultures, especially between tribal culture areas. An example of how diverse these cultures were can be seen in the area's 13 distinct native languages, which were associated with 8 separate language families. (By comparison, Europe has only 3 native language families.) Chinook jargon and sign languages helped people communicate across language and cultural barriers, especially for trade purposes. Map 2-34 shows the locations of American Indian reservations in the project area. Table 2-31 lists the project area's federally recognized tribes in each culture area and the bands within each tribe. Appendix 8 provides more information on each tribe.

Most American Indian uses of public lands today are rooted in traditional native cultures and socio-economic practices.

The economic, political, religious, and social systems of American Indian groups were interdependent and integrated. Native peoples traditionally organized by families, autonomous villages, and to a lesser degree, bands. Their associations and alliances were closest with neighboring villages. Political, economic, and subsistence strategies were focused on local environments. However, trade networks, trade centers, and task groupings, which interacted with surrounding culture areas, extended the focus of bands and villages.

Access to and availability of natural resources were crucial to native people, who formed attachments to specific places for fishing, hunting, and gathering during a yearly cycle of seasonal migrations (see also Cultural Place Attachments and Harvestability discussions later in this section, and see Figure 2-21). People collected food, medicines, and other materials and used many places and resources for religious practices and social gatherings. Plants, usually gathered from scablands, meadows, canyons, aquatic environments, and forests, are thought to have provided over half of native people's diets. The rest of their diet came from fish, mammals, and birds, which were available in varying amounts. These and other natural resources were an integral part of tribal culture, and are still culturally significant to American Indians.

It is estimated that American Indians of the Columbia may have harvested 18 million pounds of fish annually, both for their own uses and for trade purposes. In the higher deserts and headwater areas, where fish were less abundant, American Indians hunted large wildlife species such as deer, pronghorn, bighorn sheep, moose, elk, bison, and bear for food and clothing. For some people, edible plants (especially roots, celeries, berries, fruits, and nuts) provided a significant amount of their nutritional needs. Some plants were used for ceremonial, medicinal, and/or commercial purposes. Hunting and fishing practices reflected a conservation ethic—such as primarily catching male trout and salmon on the spawning beds and restricting fishing to nights or certain days, thus allowing a portion of fish to pass. Conservation elements also were embodied by selective digging



Map 2-34. American Indian Reservations

INTERIOR COLUMBIA BASIN ECOSYSTEM MANAGEMENT PROJECT

Supplemental Draft EIS Area 2000

50 0 50 100 150 miles

50 0 50 100 150 km

N

Reservations

Major Rivers

Major Roads

Supplemental Draft EIS Area Border

Tribal Headquarters

1 *Blackfeet*
2 *Burns Paiute*
3 *Coeur d'Alene*
4 *Colville*
5 *Duck Valley*
6 *Flathead*
7 *Fort Bidwell*
8 *Fort Hall*
9 *Fort McDermitt*
10 *Kalispel*
11 *Klamath*
12 *Kootenai of Idaho*
13 *Nez Perce*
14 *Pit River*
15 *Quartz Valley*
16 *Shoshoni NW Band*
17 *Spokane*
18 *Summit Lake*
19 *Umatilla*
20 *Warm Springs*
21 *Wind River*
22 *Yakama*

Table 2-31. Affected Tribes and Bands in the Project Area.

Name of Federally Recognized Tribe(s)[1]	Culture Area	Names of Bands and/orTribes
Blackfeet Tribe	Plains	Southern Piegan, Bloods, Siksika, Northern Piegan
Burns Paiute Tribe	Great Basin	Wada Tika, Hunipui, Walpapi, Koa agai, Kidu
Coeur d Alene Tribe	Plateau	Coeur d Alene, Spokane, San Joe (St Joseph) River
Confederated Salish & Kootenai Tribes	Plateau	Salish (Flathead), Kootenai, Upper Pend d Oreilles
Confederated Tribes of the Colville Reservation	Plateau	Methow, Sanpoil, Lakes (Senijextee), Colville (Sweelpoo), Entiat (Pisquouse), Nespelem, Chelan (Kow-was-say-ee), Moses Columbia (Senkaiuse), ChiefJoseph band of Nez Perce, Wenatchi (Wenatshapam/ Pisquouse), Southern Okanogan (Sinkaietk), Snake River Palus (Palouse)
Confederated Tribes of the Umatilla Indian Reservation	Plateau	Umatilla, Cayuse, Walla Walla
Confederated Tribes of the Warm Springs	Plateau	Wasco, Dalles (Kigal-twal-la), Dog River, Reservation Warm Springs (Taih) or Upper Deschutes, Lower Deschutes Wyam, Tenino, John Day River (Dock-Spus)
	Great Basin	Northern Paiutes
Confederated Tribes and Bands of the Yakama Nation	Plateau	Klickitat, Klinquit, Liay-was, Kow-was-say-ee, Oche-chotes, Palouse, Shyiks, Pisqouse, Se-ap-cat, Skinpah, Wishram, Wenatshpam, Yakama, Kahmilt-pah
Fort Bidwell Indian Community of Paiute Indians	Great Basin	Gidutikad
Fort McDermitt Paiute and Shoshone Tribes	Great Basin	Northern Paiute, Shoshone
Kalispel Tribe of Indians	Plateau	Aqulispi lem, Slate ise
Klamath Tribes of Oregon	Plateau Great Basin	Klamath, (Ma klaks), Modocs, Yahooskin
Kootenai Tribe of Idaho	Plateau	Upper and Lower Kootenai
Nez Perce Tribe	Plateau	Nez Perce (Ni mi pu), Upper and Lower Wallowa (Pikunema, Lamata)
NW Band of Shoshoni Nation	Great Basin	Eastern Shoshone (Washakie)
Pit River Tribe of California	California	Ajumawi, Aporige, Astariwawi, Atsuge, Atwamsini, Hammawi, Hewisedawi, Illmawi, Itsatawi, Kosalektawi, Madesi
Quartz Valley Indian Community	California	Shasta, Karok
Shoshone Tribe of the Wind River Reservation	Great Basin	Eastern Shoshone, Arapahoe (not affected)
Shoshone-Bannock Tribes (Fort Hall Reservation)	Great Basin	Eastern Shoshone (including Lemhi), Bannock
Shoshone-Paiute Tribes (Duck Valley Reservation)	Great Basin	Western Shoshone, Northern Paiute
Spokane Tribe	Plateau	Upper Spokane (Snxwemi ne), Middle Spokane (Sqasi Ini), Lower Spokane (Sineka lt), Chewelah
Summit Lake Paiute	Great Basin	Paiute

Band names in parentheses are either used in treaty or executive order documents or are names recognized by tribes. Legally recognized or the most common spellings were used for most tribe and band names. There were actually many more bands than are indicated; only the more generally used designations are shown.

An "Indian tribe" means any Indian tribe, band, nation, or other organized group or community, including any Alaska Native village or regional or village corporation as defined in or established pursuant to the Alaska Native Claims Settlement Act, which is recognized as eligible for the special programs and services provided by the United States to Indians because of their status as Indians.

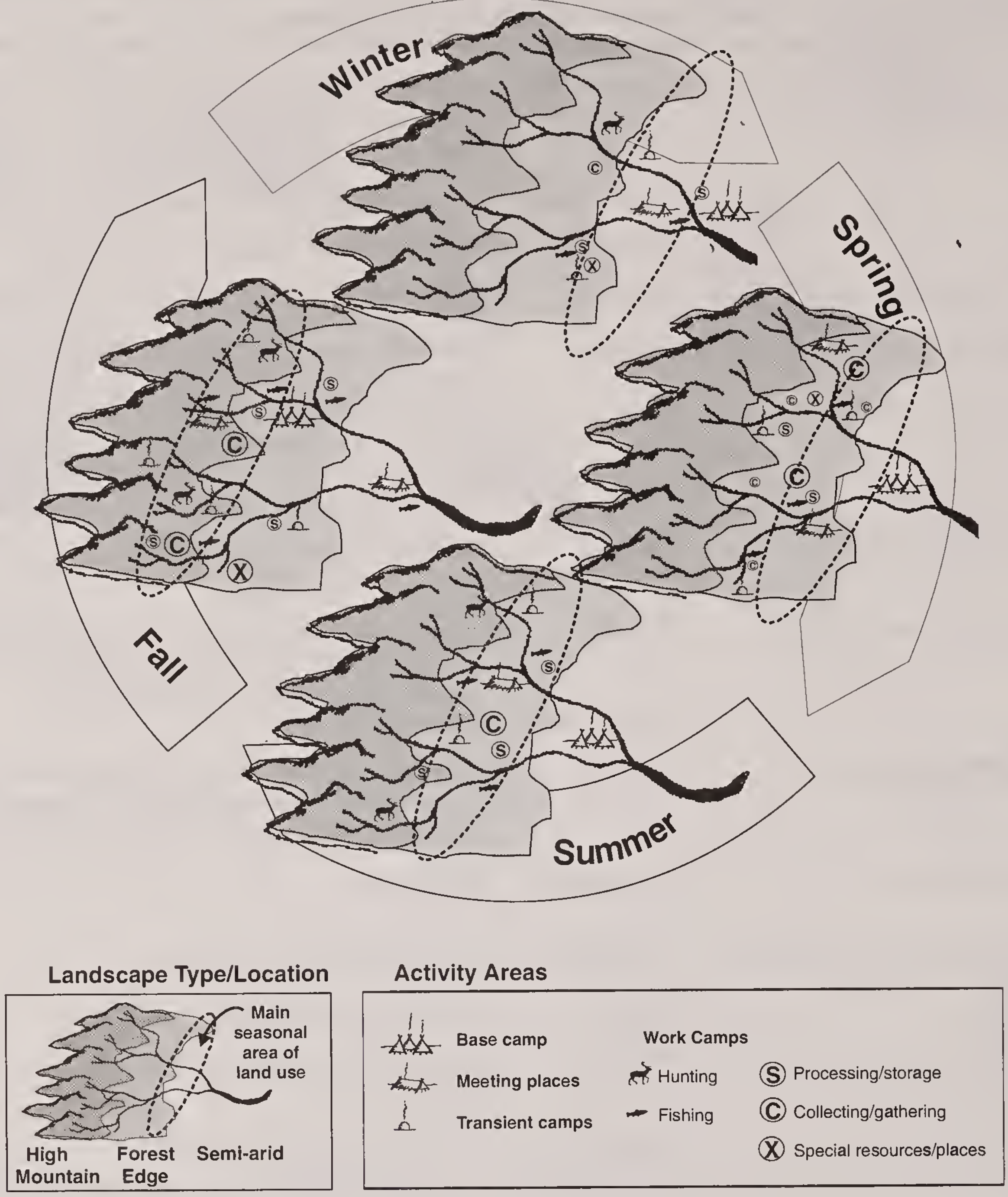


Figure 2-21. Seasonal Migrations. An example of how an American Indian band might have traveled across the land within and beyond their homeland. As each season progressed, family units left their lowland winter residence and followed the seasonal cycles of aquatic and terrestrial plants and animals as they became available for harvest.

techniques for plant food harvesting, and the timing of harvests for native plants and animals.

Well-traveled routes between villages, temporary camps, resources, and gathering places were used for seasonal migrations. Winter and summer villages, which served as residential bases, were established based on the availability of water, shelter, food, and other resource needs. Resources were not found in the same abundance in each band's subsistence area. The annually varying abundance of anadromous fish, subsistence animals, and food plants in known gathering areas was balanced by trade with other bands. The geography and distribution of resources in each band's subsistence areas along with differing family strategies created unique seasonal migration patterns.

Both Plateau and Great Basin groups had resource areas that drew bands together to share resources in particularly rich places. Premier fisheries were found in the Columbia, Snake, and Klamath rivers; and The Dalles/Celilo Falls, Kettle Falls, Upper Klamath Lake, and Boise Falls. Well-known plant gathering places in the project area included the Grande Ronde Valley in Oregon, Idaho's Camas Prairie, and meadows and prairies south of the Spokane River in Washington. These places were also significant meeting areas, trade centers, and habitation sites.

Changes in Uses of and Relationships with the Land

Early Land Uses and Relationships

Although early populations are difficult to estimate, the project area's tribal population was likely highest in the mid 1700s. American Indian populations generally had increased in areas and times that had abundant natural resources, and they decreased during long periods of scarce resources. The introduction of the horse in the 1700s and early 1800s increased people's ability to collect and store food, which in turn increased native populations. In the early 1800s, diseases introduced by European settlers and missionaries significantly reduced native populations by as much as 90 percent in large regions in the project area, decimating societies and cultures.

By the 1860s, the Oregon Trail and military roads opened the way for mass Euroamerican settlement, and Indian peoples no longer constituted the majority population in the area. The culture and philosophy of the new people were quite different from the native people's system of seasonal migrations and interdependence with natural resources. In general, the new Americans settled in one place year-round, which created different, potentially more disruptive, impacts on the landscape compared to the seasonal migratory patterns of American Indians.

Native people had burned vegetation to maintain their environment at certain times of the year, but their fires differed in intensity, timing, and location from later fires in project area ecosystems. The new settlers introduced additional disturbances to native systems, including intensive commercial fishing, sheep and cattle grazing, agriculture, fire suppression, and generally more efficient means for large scale resource extraction, among others. Specific modifications to native systems are summarized in other parts of this chapter and described in more detail in the *Scientific Assessment* (Quigley and Arbelbide 1997).

Land uses and seasonal migration patterns for Indian people were altered as a result of the influx of new settlers with new cultures. The steady growth of Euroamerican populations caused conflicts over resource use and availability, as well as pressure to change American Indian cultures. The competition and conflict between native and Euroamerican people in the 1800s resulted in a treaty-making period between tribes and the U.S. government.

After the Treaty-making Period

When the federal government signed treaties with American Indians, it assumed a legal obligation in which the Indians trusted the United States to fulfill commitments given in exchange for cessation of Indian claims to land. Treaties are agreements between sovereign nations and are considered "the supreme law of the land" in the U.S. Constitution (Article VI. Clause 2). Tribes were identified as distinct groupings of American Indian people with a political structure. Such federal 'recognition' as a political entity had and still has some trust obligations and entitlement to many federal Indian services.

In signing treaties, most tribes ceded lands in exchange for set-asides, exclusive-use reservations, services, and promises of access to traditional land uses such as hunting, fishing, gathering, and livestock grazing. The tribes hoped this would preserve their cultural and subsistence activities and traditional economic lifeways for current and future generations. Indian reservations were seen by both tribes and government as a way to limit conflicts and allow tribes to retain some land even though reservations were often outside tribal homelands.

American Indian use of the land became restricted by removal from their homelands and a shift onto Indian reservations (Map 2-34, earlier in this section). Many tribes lost their ability to remain self-sufficient because they were deprived of a land base large enough to supply a subsistence, and they became dependent on federal government assurances in the treaties. Bands, communities, and even families were divided among reservations, often further separating them from their traditional use areas and resources. However, many Indians continued off-reservation use of their homelands, and some maintained off-reservation communities.

Traditional lifeways persisted even as Indians increasingly conformed to non-Indian lifestyles. The largely separate reservation communities often imitated and interacted with counterpart, non-Indian communities. The internal conflicts and divisions that accompanied cultural changes were limited by social forces based on family ties, a shared heritage, and cultural background.

These same factors bound people and their communities to certain off-reservation lands. American Indians seasonally sought out familiar resources and places, regardless of land ownership. They developed understandings with landowners and trade opportunities with those communities they encountered. During economically depressed periods, such as the Great Depression, renewed reliance on traditional

foods and other practices helped sustain many tribal economies. Inevitable conflicts over land use led to reduced tribal access to resources and traditional places.

American Indians changed along with regional developments and governmental regulations. For example, many Indian families came to depend increasingly on automated modes and routes of travel. Various federal agencies management actions and policies for public lands in the early 1900s changed and continue to change American Indian uses of lands in many ways. By the mid 1900s, assimilation policies and influences caused traditional cultures and values to become narrower aspects of American Indian life. However, traditional cultures and values are themselves largely unchanged. Most American Indian uses of public lands today are rooted in traditional native cultures and socio-economic practices. Of special relevance to federal land managers are the places and natural resources that traditional Indian communities continue to recognize as a part of their living cultural heritage.

Legal Agreements

Federal Trust Responsibility

The trust responsibility is not defined, in part because of reluctance by both tribes and the Congress to place limits on "trust." The modern concept of trust responsibility can be traced to the Treaty of Ghent, 1814. Chief Justice Marshall later characterized American Indian tribes as "domestic dependent nations" involving (1) the government or nation-state status of tribes, and (2) a special tribal relationship with the United States (Cohen 1982). Marshall described the trust relationship as one that "resembles that of a ward to his guardian." This relationship has been consistently recognized by federal courts ever since and has been described as "special", "unique", "moral", and "solemn".

The primary focus of the federal government trust responsibility is the protection of Indian-owned assets, natural resources on reservations, and the treaty rights and interests that tribes reserved on off-reservation lands.

In addition, the rights reserved by the tribes in treaties and agreements, or which were not expressly terminated by the Congress, continue to this day. These tribal rights and authorities extend to any natural resources which are reserved by treaties, executive orders, and federal statutes. The federal courts have developed the Canons of Construction, guiding premises, that treaties and other federal actions "should when possible be read as protecting Indian rights in a manner favorable to Indians" (Cohen 1982).

The judiciary interpretation of tribal rights and treaty language continues to evolve and define federal legal responsibilities. For example, a 1994 court decision involving shellfishing rights determined that treaty-reserved resources were not limited to those actually harvested at treaty time because the right to take any species, without limit, pre-existed the treaties (*United States vs. State of Washington* 1994).

The primary focus of the federal government trust responsibility is the protection of Indian-owned assets, natural resources on reservations, and the treaty rights and interests that tribes reserved on off-reservation lands. Congress also adopted laws and policies that protect tribes' rights to self-determination and promote the social well-being of tribes and their members. Under various laws and policies, agencies have a responsibility to implement federal resource laws in a manner consistent with a tribes' ability to protect their members, to manage their own resources, and to maintain themselves as distinct cultural and political entities. Forest Service and BLM responsibilities apply to those actions under their authority, affecting management activities on lands they administer relative to plant and animal habitats, for example.

In carrying out their responsibilities, the BLM and Forest Service must assess proposed actions to determine potential impacts on treaty rights, treaty resources, or other tribal interests. Where potential impacts exist, the agencies must consult with affected tribes and explicitly address those impacts in planning documents and final decisions. Consultation with the tribes, described later in this section, is an essential step in carrying out that responsibility.

A key issue is the federal government's obligation to ensure that tribal treaty rights and interests will be protected. Agencies often consider that their responsibility is carried out when tribal interests have been considered prior to making land use decisions. However, consultation and consideration alone may not be enough to redeem federal responsibilities. Tribes contend that treaty resources must actually be protected before land management activities can proceed. Despite the legal disputes about procedural

Cultural Significance

Cultural significance refers to a set of relationships between a group of people, their culture, and their world (landscapes, places, and living and inanimate things). These relationships define and are defined by the values, uses, meanings, and relevance people hold for their world, behaviors, activities, or events. Culturally significant relationships and elements should be understood and treated within the context of the culture that identifies, manages, and values them.

For example, the cultural significance of salmon in American culture is multi-dimensional. It is a food source, a symbol of persistence and fortitude in a life cycle struggle, an economic industry, a prized game fish, a regional political and environmental issue, and a symbol of the Pacific Northwest region. For many American Indians, additional significance of salmon is founded in their religions, socio-cultural values, and identity as a community or a people.

A better understanding of significance is found in how people relate to salmon through any of the above ways. For sports fishermen, salmon is revered for its size and fight; a single large catch brings individual esteem. Fishing stories provide social bonding and bravado. Indian fishermen revere salmon (steelhead included) as a divinely provided food; it is a "lead-fish" essential on the tables at community dinners. A large catch of fish (enough to both sell and give away) brings social esteem to both the fisherman and the skilled salmon handlers who prepare and serve the catch. Stories about salmon bond individuals, family, society, places, and land together.

duties associated with project decision-making processes and substantive duties consisting of guarantees, federal fulfillment of trust is ultimately measured by the actual effects of federal actions.

Other Agreements

Although the treaty-making era ended in 1871, negotiations with tribes continued and resulted in agreements ratified by Congress. Executive orders were signed in the late 1800s and early 1900s with the intent to reserve lands for tribal use, identify certain services, and occasionally to identify rights for non-treaty tribes. Both agreements and executive orders officially recognized tribes and created rights and liabilities that are virtually identical to those established by treaties (Cohen 1982). With regard to the applicability of the basic trust doctrine, Congress has not drawn distinctions between treaty and non-treaty tribes (Cohen 1982).

Tribal Governments

Tribal governments have broad social and natural resource responsibilities toward their memberships and often operate under different cultural and organizational goals than federal agencies. Enrolled tribal members are entitled to exercise those reserved rights and benefits held by a tribal government but are subject to tribal government regulations. Differences in the character of tribal organizations exist among tribes based on how they were given federal recognition, provided reservations, and whether they adopted the Indian Reorganization Act of 1934. This act encouraged tribes to organize themselves under formal constitutions approved by the Secretary of the Interior.

Tribes have interest in reservations (owned communally by a tribe), Indian allotments (owned by individuals), and off-reservation lands (where tribes have no legal title to the land); however, the nature of interest and legal rights varies. Some tribes have a legal right to fish at all usual and accustomed places (specified in treaties) for both on and off-reservation lands, regardless of property ownership.

The Bureau of Indian Affairs (BIA) represents virtually the entire governing authority over Indian tribes, including housing, schooling, and various other aspects of their social structure. The Self-Determination and Education Assistance Act, P.L. 93-638, passed in 1975, authorized the tribes to contract to operate BIA programs. Since then, the act has been amended three times (1988, 1991, and 1994), giving participating tribes even broader authority to manage and operate Bureau of Indian Affairs and other Department of Interior agency programs.

As a result, tribes now develop and conduct a number of research and management programs comparable to those done by federal and state agencies. For example, many have developed or are in the process of developing water quality restoration plans. Many tribes also now have a Tribal Employment Rights Ordinance (TERO) (see Appendix 8), which is the core of a comprehensive legal framework of tribal, federal, and contract law designed to promote tribal preference in employment, contracting, and purchase of products and services on or near the particular reservation.

Tribes traditional and complex cultural ties to public lands still generate tribal concerns about how public lands are managed. Tribal governments, now with enhanced governing authority, directly address the broad social and natural resource concerns of their citizens. Most tribes have evolving internal organizations and deliberative skills to deal with land management agencies. Many are asking federal agencies to take a more proactive role on their behalf, especially in areas of treaty rights, treaty resources, and ecosystem health.

Current Federal Agency Relations

Existing relationships between tribes and federal agencies have evolved rapidly in recent years, partly as a result of empowerment of tribal governments and numerous federal court cases involving treaty-reserved fishing rights. The momentum has increased in response to new legal interpretations, legislation, executive orders, and departmental direction that encourages acknowledgment of tribal government issues, government-to-government consultation, and resolution of tribal concerns through consensus-seeking approaches. A chronology of these events can be found in Appendix 8.

Current Forest Service and BLM relations with tribes vary across the project area. The frequency of agency-tribe contacts often depends more on the nature of an established relationship than on whether an agency is proposing actions with potential effects on tribal interests. When an agency such as the BLM or Forest Service initiates an action (such as developing this EIS), the agency consults with affected American Indian tribes. Agencies tend to consult only those tribes which have overlapping ceded lands or neighboring reservation lands, although affected Indian groups also include others with interests in land management action(s)—even if they are non-federally recognized American Indian communities.

A number of federal agencies have revised their policies to respond to American Indian issues. These often recognize the necessity of mutual understanding and collaborative works to establish common goals and perspectives, emphasizing efforts to integrate tribal rights and interests in federal land management. Tribal perspectives are now expected to be identified and understood through the consultation process. (See further discussion of Consultation and Participation, later in this section.)

Consultation with Tribes

When used in the context of government-to-government relationships, the term consultation means:

1. An active, affirmative process which (a) identifies issues and seeks input from appropriate American Indian governments; and (b) considers their interests as a necessary and integral part of the BLM and Forest Service decision-making process.
2. The federal government has a legal obligation to consult with American Indian tribes. This legal obligation is based in such laws as Native American Graves Protection and Repatriation Act, American Indian Religious Freedom Act, and numerous other executive orders and statutes. This legal responsibility is, through consultation, to consider Indian interests and account for those interests in the decision.

The term consultation also refers to a variety of other processes and is used differently in other sections of this document. For example, consultation also refers to a requirement under Section 7 of the Endangered Species Act that federal agencies consult with the U.S. Fish and Wildlife Service and/or National Marine Fisheries Service with regard to federal actions that may affect listed threatened or endangered species or critical habitat. Consultation with American Indian tribes is a separate process. However, both are required under federal law.

Current agency regulations and federal law require the BLM and Forest Service to consider tribal interests when conducting actions that may affect natural resources on tribal lands and/or the socio-economic well-being of its people. Examples of these interests and assets include, but are not limited to, air quality, water quality and quantity, anadromous fish runs, migrating wildlife, and cultural and religious interests of the tribe. Agencies must carry out their activities in a manner that does not harm or degrade Indian trust assets, avoids adverse impacts when possible, and mitigates impacts where they cannot be avoided. Federal policies also require explicit discussion and consideration of Indian trust assets in environmental assessments and impact statements (U.S. Army Corps of Engineers 1995).

American Indian Issues

Many tangible and intangible resources, values, and issues that interest American Indians are the same as those that interest members of the general public, which are described in Appendix 1-4 of the Eastside Draft EIS and Appendix D of the UCRB Draft EIS, and are summarized in Chapter 1 of the supplemental Draft EIS. Some issues and concerns are unique to American Indians because of tribal interests, land ownership, and other characteristics that are different from those of the general public. A number of these issues are complex and often sensitive. Although many issues are similar among tribes, each tribe emphasizes those issues specific to its interests, and there may be variation in how individual tribes think land management agencies should respond. Tribal perspectives are expected to be identified and understood through the consultation process.

Politico–Legal Relations

Treaty Federal Trust Responsibility

Differing perceptions exist between the tribes and the federal government regarding trust obligations of the federal government in off-reservation settings. Tribes consider the trust obligation to be a substantive duty, one that should ensure protection of tribal interests on public lands as well as on trust lands. Where neither treaty rights nor federal trust responsibilities exist, tribes expect at least an adherence to a policy of prioritization, in which protection of tribal interests enjoys a standing over certain forms of other interests such as prioritization of water rights or uses. Tribes contend that federal land management agencies neither historically managed nor currently manage natural resources within the context of treaty agreements or federal trust responsibilities. They assert that federal agencies are obligated to protect and restore the habitats needed to support resources on which meaningful exercise of treaty rights depends.

Because the U.S. courts have not defined the precise scope of the federal-Indian trust relationship, agencies often are unsure when a responsibility is met or redeemed. Therefore, federal policy primarily focuses on consideration of treaty rights and tribal interests, commonly through a government-to-government consultation process. This interpretation of trust responsibilities has been recently identified in the Department of the Interior's Manual release 512 DM 2 (December 1, 1995), and in the Department of Agriculture's Regulation No. 1020-6 (October 16, 1992). Agencies must identify if any proposed activity will have an impact on Indian interests on public or trust lands, ensure such impacts are explicitly addressed, consult with affected tribes and document potential conflicts fully incorporating tribal views, and explain how a decision is consistent with the federal government's trust responsibility.

Treaty resources located outside reservation boundaries have "in common" status; that is, resources are not reserved for the exclusive use of tribes. As such, these are considered "treaty resources" rather than "trust resources". Off-reservation resources of interest to tribes may be subject to competing and conflicting uses which in some circumstances may be more compelling and supersede the tribal rights and interests.

Despite these divergent interpretations, treaty rights and trust obligations serve to further shape a unique intergovernmental relationship requiring at minimum that federal agencies identify tribal interests and needs and account for these in their decisions.

Consultation, Coordination, and Collaboration

The intergovernmental consultation process serves as the primary means for federal agencies to carry out their trust responsibilities. Legal requirements for federal agencies to consult tribes and American Indian communities has its basis in federal law, court interpretations, and executive orders (see Appendix 8).

Consultation serves at least five purposes:

- To identify and clarify the issues,
- To provide for an exchange of existing information and identify where information is needed,

- To identify and serve as a process for conflict resolution,
- To provide an opportunity to discuss and explain the decision,
- To fulfill the core of the federal trust obligation.

Consultation should be viewed as an ongoing relationship between an agency (or agencies) and a tribe (or tribes), characterized by consensus-seeking approaches to reach mutual understanding and resolve issues. It can be either a formal process of negotiation, cooperation, and policy level decision-making between tribal governments and the federal government, or a more informal process.

Consultation has been variably defined and implemented. Among tribes there are as many definitions for consultation and fulfillment of trust as there are Indian nations. For example, the Confederated Tribes of the Umatilla Indian Reservation define consultation as a formal process of negotiation, cooperation, and policy-level decision-making between sovereigns on a government-to-government basis aimed at reaching mutual decisions that will protect tribal lifestyle, culture, treaty rights, religion, and economy. Other tribes may define it differently. For that reason, consultation is conducted with each tribe individually.

Regardless of definition or type of process, all tribes believe that consultation and collaboration must be substantative, which occurs when: (1) opportunities for involvement are commensurate with the governmental status of tribes, (2) there is an agency focus on being responsive (more than polite listening), and (3) the subsequent decisions/outcomes reflect agency responsiveness through results, which may include shared agreement or mutually identified mitigation. Effective collaboration from the tribal perspective must include collaboration in implementation as well as full representation on any intergovernmental oversight groups that may be established. The challenge of agency-tribe consultation lies in achieving federal consideration of different cultural values, legal responsibilities, management processes, and collaborative relationships.

Formal consultation on every site-specific federal activity would be impossible for every tribal government to undertake. For many it would be preferable to have policy level decision-making, involving tribal policy makers, that would apply to all activities. A useful model of agency-tribe interactions is seen to include three important components: policy making, federal activities, and technical level management. Each component is viewed as an individual process operating concurrently and relative to the others, reflected in government-to-government consultation.

Currently, agency-tribe relations infrequently incorporate such a strategy formally. Consequently, agency-tribal relations often are not addressed in a context that would enable adaptive responses to agency operations and tribal rights and concerns. Collaborative processes to establish agreeable consultation procedures and concerted efforts to provide shared understanding of agency missions and tribal rights and concerns are lacking.

Ethno-habitat Management

Culturally Important Species and Habitats

The availability of culturally significant species and access to socially and/or traditionally important habitats (ethno-habitats) support the well-being of Indian communities. Many social, cultural, and economic activities center on the harvest, preparation, trade, and consumption of such resources. The occurrence of culturally significant species can be predicted through their known associations with types of landscapes and habitats. The presence and health of ethno-habitats can be assessed by using ecological information and the cultural expertise of a tribe and traditional users. The degree of access to resources and places can be determined by examining the potential effects of physical obstacles, administrative barriers, and/or behavior constraints that management actions may impose.

Availability of culturally important species is a key component of the issue of harvestability, discussed in more detail below. Table 2-32 presents species population trends in the project area from historical to current periods for many species of special interest to tribes.

Basin-wide Habitat Standards

Restoration of native species habitats is central to many tribal interests. However, the term "restoration" can have varying meanings, and its lack of a single definition is seen to impede effective restoration activities. Many tribes consider current agency restoration efforts (including those under PACFISH) to be inadequate with regard to protection of habitats. Most tribes have their own restoration plans, such as the Upper Grand Ronde Plan and the Wy-Kan-Ush-Mi Wa-Kish-Wit, the Columbia River Intertribal Fish Commission Salmon Restoration Plan.

Table 2-32. Population Trends of Species Associated with the Rights and Interests of Tribes in the Project Area.

Species Name	Population Trend	Regulation	Comments
Anadromous salmonids	Declining	Federal, state, and tribal	Primary cause for decline is due to human-caused effects on habitat from hatcheries, dams, and harvests. Some species are currently listed as threatened or endangered, such as Snake River sockeye, and spring and fall chinook salmon.
Resident salmonids, whitefish	Declining	Federal, state, and tribal	Primary cause for decline is human-caused degradation of headwater and main-stem habitat and hatchery influences. Research on metapopulation interactions of species is still needed.
Sturgeon, lamprey	Declining	Federal, state, and tribal	Main-stem hydroelectric dams have changed free flowing systems into slack water environments, and these dams impede local migration. Much information is still needed on these species. Freshwater habitat degradation is thought to have a negative effect.
Sucker, sculpin, mussel	Unknown	Federal, state, and tribal	Detailed, accurate information is lacking on many of these species. Species endemic to portions of the project area are facing immediate threats to survival because of poor recruitment and water rights issues.
Mule deer, elk, black-tailed white-tailed deer, pronghorn, and moose	Significant increase from over-hunting in late 1800s. Current populations stable. White-tailed deer and elk increasing range. Pronghorn and moose recovering some lost historic range.	State and tribal for hunting numbers and seasons	In general, these big game species have increased due to control of commercial hunting in the late 1880s and their adaptability to early seral vegetation and edge habitat created by logging. Intensive management of habitat, as well as control over harvest, have increased populations.
Mountain goat	Declining populations, although historic range has increased into other habitats.	State and tribal for harvest	This species was impacted by competition for forage from domestic sheep and trophy poaching. Forage has not regenerated well due to fire suppression.
Bighorn sheep	General decline from historic populations, although some local gains in recent decades.	State and tribal for harvest	Bighorn sheep have declined because of disease transmission from domestic sheep, and fragmentation of seasonal range by roads and houses. They have also been impacted by competition for forage from domestic sheep and trophy poaching. Forage has not regenerated well due to fire suppression.
Grizzly bear, gray wolf	Declining since the mid 1800s to near extinction. In the past 30 years, increasing due to protection and immigration from Canada. Populations stable.	Protected by U.S. Fish and Wildlife Service threatened (grizzly) or endangered (gray wolf)	Grizzly bears are isolated in large blocks of relatively undisturbed moist and cold forest in northern Washington, Idaho, Montana, and the Yellowstone ecosystem. Wolf populations are increasing in the same habitat areas and starting to move into other habitats in northern portions of the project area. There is concern for poaching, public fear of predators, road access to habitat, prey base stability, isolation of populations, and conditioning of predators to human foods and livestock.

Table 2-32. Population Trends of Species Associated with the Rights and Interests of Tribes in Project Area. (continued)

Species Name	Population Trend	Regulation	Comments
Black bear	Variable by state. Some states have changed hunting regulations, populations have increased. Stable elsewhere.	State and tribal for harvest	Black bears are habitat generalists and have benefitted from early and seral vegetation and edge habitat created through logging. Population trends are not well known, nor is the impact of baiting, human conflicts, and harvest. Fire suppression and changes in berry production and habitat structure may impact bears. Competition between bears and domestic sheep for vegetation is a concern.
Jackrabbit, Nuttail's cotton-tail, pygmy rabbit, snowshoe hare, sage grouse, sharp-tailed grouse	Decreasing	State for harvest	Significant decline in sagebrush and salt desert shrub cover types, along with invasion of noxious weeds and other undesirable plants (such as cheatgrass), and excessive livestock grazing pressure, have seriously decreased forage and cover for grouse and rabbits. Snowshoe hares have been impacted by fire suppression and decreases in young lodgepole pine, riparian shrub, and hardwood stands.
Forest grouse (blue grouse, spruce grouse, and ruffed grouse)	Decreasing	State and tribal for harvest	Fire suppression, increasing stand density, decreasing shrub and riparian vegetation, and a decreasing large tree component have all impacted blue and spruce grouse. Ruffed grouse may be increasing in dense mid seral stands, but there is a lack of data.
Bald eagle, golden eagle, other raptors, Swainson's hawk, ferruginous hawk	Most are increasing. Rangeland hawks decreasing due to conflicts for winter range.	U.S. Fish and Wildlife Service and tribal	Raptors that declined due to pesticide use and human mortality have generally increased with regulation of pesticides and public education. Decline in the large tree component; old-forest, open stand structure; and prey species is still a concern. Swainson's and ferruginous hawks and others dependent on large open areas have declined due to conflicts in winter range.
Canada goose, ducks, coot, heron, swans	Geese are increasing. Ducks declined until a recent upward trend.	State, tribal, and U.S. Fish and Wildlife Service	Canada geese have responded well to artificial nest boxes, grazing, agriculture, and domestic grasses. All waterfowl have been impacted by a decline in wetlands, de-watering, lead shot, disease, and poaching.
Bitterroot, biscuitroot, mariposa, yampah	Stable, some locally impacted.	Tribal	Scabland species are generally not affected by livestock grazing or fire. Some areas are impacted by road construction and other ground disturbances. Some local losses noted for mariposa and yampah from past intensive grazing. Grazing time can conflict with tribal gathering practices. Noxious weeds, such as yellow starthistle, threaten some mariposa species. Also, some scablands are being invaded by noxious weeds such as diffuse knapweed.

Table 2-32. Population Trends of Species Associated with the Rights and Interests of Tribes in Project Area. (continued)

Species Name	Population Trend	Regulation	Comments
Willows, tules, cattails, wocas (lilypods), wappatoo	Decreasing	EPA, U.S. Fish and Wildlife Service, and tribal for wetlands	Degradation and loss of riparian and wetland habitat due to grazing, timber harvest, de-watering, mining, and roads have all caused declines in these species. Legally declared noxious weeds, such as purple loosestrife, are invading wetlands and have caused or are causing known declines in cattails.
Camas, yampah, beargrass	No data	Tribal	In general, upland herblands and meadows have decreased in geographic extent and condition because of fire suppression, excessive livestock grazing pressure, conifer encroachment, soil disturbance and compaction due to logging, and exotic/undesirable plant species invasions. Impacts on herbs from historically heavy sheep grazing are gradually showing recovery.
Mushrooms, elephant ears, morels, and other fungus sporocarps and beargrass	Unknown, wild mushrooms are a product of diverse and complex interactions within natural ecosystems.	Federal and state (wild mushroom harvesting falls under tribal regulation)	Commercial mushroom harvest, land management activities, and catastrophic events such as fire, disease, and insect epidemics all play a role in fungi productivity. There has been an increase in the harvest of special forest products and conflict with tribal gathering practices. There is a need for long-term study and monitoring of many commercially harvested species to understand their role in the productivity of ecosystems.
Huckleberry, elderberry, buffalo berry	Decreasing	Some units limit gathering	These species and other forested shrubs have declined due to suppression of fire, grazing, increased stand density (limiting light, water, and climate), and competition for harvest.
Chokecherry, serviceberry	Variable. Serviceberry expanded in some areas, but age and structure diversity is lower. Chokecherry in riparian areas has declined.	None	Changes to berry production and other qualities important to tribes are unknown. There have been increases in chokecherry harvests by the public. Increasing ages of shrubs due to fire suppression is a concern.
Juniper	Increasing in distribution, but decreasing structural diversity.	None	Juniper has invaded other habitat types and stands have become denser, older, and less diverse with fire suppression and excessive livestock grazing pressure.
Mountain mahogany	Declining	None	Mountain mahogany stands are becoming older, with a concomitant decrease in structural diversity. There has been a shortage of recruitment of new mahogany plants. Some areas are heavily browsed. Research on regeneration is needed.

Tribes feel that restoration should emphasize conservation and recovery of high quality habitats, especially in riparian areas. They place emphasis on the analysis of cumulative effects, including: (1) assessment of ongoing impacts in watersheds resulting from current and past BLM/Forest Service land management activities; (2) full inventory of watershed/riparian conditions and activities, such as stream crossings, road density, grazing, mining, logging and estimated sediment delivery; (3) correlation of stream conditions with habitat standards based on surveys of all listed fish bearing streams; and (4) suitability determination for grazing that goes beyond the concept of Proper Functioning Condition. Tribes also focus on restoring degraded conditions of watersheds, decreased salmonid populations, and loss of old-growth ponderosa pine and general old-growth structure.

Although tribes emphasize conservation measures, they also support adaptive management principles that address ecosystem health problems through prescribed burns and road re-construction and maintenance.

Harvestability as Soon as Possible

The health and availability of resources for harvest are of great interest to American Indian cultures. Tribes use the concept of harvestable populations to define a desired level of harvest for subsistence, commercial, spiritual, and cultural needs. Habitat for harvestable population levels of salmonids and other fish, wildlife, and plant species is seen as critically important to tribal cultures and the meaningful exercise of reserved rights where they exist. Information and population trends for a sample of species of concern are shown in Table 2-32.

Many tribes interpret sustainability and harvestability of tribally important species to be an extension of federal concepts and of Endangered Species Act requirements for species viability. The BLM and Forest Service generally maintain that although they are not directly responsible for managing species populations, they are responsibile for the habitats upon which species depend. They acknowledge that agency management actions can influence harvestability, but they have less control over a species' population response to that habitat. Management of plant species populations is more commonly the responsibility of the Forest Service and BLM, which have a greater opportunity to positively influence harvestability of these species.

Harvestability also is a combination of animal or plant availability and access to harvest them. Managing access is one of the more effective tools that the Forest Service and BLM have to protect a species and its habitat. However, while restrictions on access may protect a species and its habitat, it may also reduce harvestability by making animals or plants harder to take or gather.

Habitat condition is the best measure of Forest Service and BLM ability to maintain or restore harvestability for most species, including widely distributed plants such as huckleberries and mushrooms.

Habitat condition is the best measure of Forest Service and BLM ability to maintain or restore harvestability for most species, including widely distributed plants such as huckleberries and mushrooms. Land use plans generally include habitat condition indicators for important aquatic and terrestrial species (such as fishes, elk, and deer). For some very rare species (such as plants restricted to only a few sites), actual population numbers are sometimes measured to prevent overharvest.

For some species associated with the rights and interests of tribes, sufficient habitat is or can be made available for harvestable populations in the shorter term (10 to 15 years). However, in the case of anadromous fish, habitat accounts for only a portion of one of several factors related to recovery and harvestability. Other factors outside the authority of Forest Service and BLM decision makers (harvest, hydropower, habitat on lands not administered by the Forest Service or BLM, and hatcheries) also contribute to harvestability of anadromous fish populations. The Pacific Salmon Treaty, the court case *U.S. vs. Oregon*, and the rebuilding goals of the Northwest Power Planning Council, among other efforts, have addressed the issue of salmon harvestability. Columbia River Tribes have developed a Tribal Restoration Plan, Wy-Kan-Ush-Mi Wa-Kish-Wit, which contains specific, quantified objectives.

There is a predicted disparity between harvestability and viability, a distinction which is relatively more critical for anadromous fish than for terrestrial wildlife and culturally significant plant species. Forest Service policy requires and BLM policy is consistent with providing habitat capable of supporting viable populations of existing native and non-native vertebrate species. The determination of a viable population level also defines the level of escapement required for salmon conservation purposes, which in turn has been used to describe the potential for future harvestable anadromous fish populations. The extent to which there may be a legal obligation imposed on the federal government to provide habitat capable of supporting harvestable levels of resources from public lands will not be resolved in this EIS.

Socio-economics

Tribal Economics and Employment

A number of elements relevant to Forest Service/BLM land management decisions are considered crucial to tribal community well-being, including:

- Indian reservations and allotments, ceded lands, traditional homelands, areas of tribal interest, and areas of mutual interest with other tribes;
- Cultural survival;
- Treaty rights;
- Trust assets and resources;
- American Indian religious practices;
- Cultural heritage resources and places; and
- Tribes' socio-economic well-being.

Tribal community health and well-being are thus based on a number of factors, including economic growth, employment, freedom to pursue traditional uses of the land, effective trust relationship with the federal government, and lack of infringements on religious practices.

Reservation communities are some of the most economically depressed areas in the United States (Bureau of Labor Statistics, American Indian Labor Force, January 1991). The employment and income levels in tribal communities tend to be significantly lower than state and national averages. For example, the average unemployment rate among counties containing tribal communities within the project area currently is approximately 10 percent (with some reservations estimated in 1995 to be as high as 73 percent [USDI Bureau of Indian Affairs 1995]); the current national unemployment rate is approximately 4.8 percent.

Tribes and tribal communities depend on Forest Service- and BLM-administered lands for economic, cultural, subsistence, religious, and treaty purposes. The culture as well as the rights and interests of American Indian people are rooted in these lands, their traditional homelands. Tribal teachings are based upon understanding the relationship between themselves, as a people, and the land and its resources. While these values cannot be quantified in an economic context, tribal economic participation and community well-being are important considerations in the management of these lands.

Tribes and tribal communities depend on Forest Service- and BLM-administered lands for economic, cultural, subsistence, religious, and treaty purposes.

Cultural Place Attachment

Indian people have long held pronounced and special attachments to the land, which are understood and expressed through their relationships with culturally significant places (see Cultures discussion, earlier in this section). Consequently, traditional land uses usually occur in the context of culturally significant places, through which place attachments and values have become embedded elements in Indian cultures and religious beliefs. Tribal interests in the integrity of such places involve a range of area types: areas of interest, landscapes, traditional use areas, and other localities such as ethno-habitats, burial sites, and archeological sites. Cultural places may be valued at the community, tribal, and inter-tribal levels.

While non-Indian people also have cultural place attachments, distinctions in the types and intensity of place attachments are recognized by traditional American Indian communities and tribes compared to those recognized by the general public. These differences are in part based on: (1) the greater length of time native cultures have spent in the project area; (2) the greater degree place attachments have been integrated into their culture systems of religion, economy, politics, and social / kinship; and (3) cultural values, histories, and relationships to landscapes, which vary from mainstem American culture and are typically not understood by the general public. Consequently, some cultural place information may be inappropriate for public dissemination. This is sometimes addressed with place assessments conducted solely for American Indian groups.

Cultural Resource and Cultural Practices Protection

Federally administered lands must be in compliance with a number of federal laws and regulations protecting cultural resources, including the Antiquities Act, the Archeological Resources Protection Act (ARPA), the Native American Graves Protection and Repatriation Act (NAGPRA) and the National Historic Preservation Act (NHPA). Generally, academic and legal definitions define cultural resources as the physical and nonrenewable evidence of human occupation or activity as seen in any area, site, building, structure, artifact, ruin, object, work of art, architecture, or natural feature, which was important in human history at the national, state, or local level.

This definition refers mainly to archeological sites or other tangible entities, and is best assessed at the fine scale. The site-specific nature of this evidence is beyond the broad-scale scope of this document and is addressed in BLM and Forest Service land use plans, activity plans, and other local environmental and ecosystem analyses.

American Indians often find this definition too narrow. They consider cultural resources to include their entire heritage, including beliefs, traditions, customs, and spiritual relationship to the earth and natural resources (U.S. Army Corp of Engineers 1996). If federal protection of archeological sites and traditional cultural properties were better understood in terms of tribal natural resource interests, consideration of heritage resources could be integrated with efforts to rehabilitate plant gathering places and native plant communities and efforts to restore watershed health and function.

Many Forest Service and BLM administrative offices have not always agreed with tribes on how to implement legal requirements for cultural resource protection (such as NAGPRA, NHPA, and ARPA). This includes plans for locating and evaluating Traditional Cultural Properties under Section 106 of NHPA, which would allow for full participation of tribes in performance of cultural resource inventories.

Factors Influencing Health of Ecosystems

Key Terms Used in This Section

Disturbance — Refers to events that alter the structure, composition, or function of terrestrial or aquatic habitats. Natural disturbances include, among others, drought, floods, wind, fires, wildlife grazing, and insects and diseases. Human-caused disturbances include, among others, actions such as timber harvest, livestock grazing, roads, and the introduction of exotic species.

Excessive livestock grazing pressure — Grazing pressure that results in a decline in physiological vigor of plants, typically observed as a decline in reproductive output (for example, seeds and rhizomes) and growth, both above ground (for example, tiller production of grasses) and below ground (for example, root growth). This decline in physiological vigor results in decreased ability of the plant to compete for resources and results in alteration of plant species composition in plant communities. The connotation of this phrase is negative.

Exotic species — A plant or animal species introduced from a distant place; not native to the area.

Habitat Fragmentation — The break-up of a large land area (such as forest) into smaller patches isolated by areas converted to a different land type. The opposite of connectivity.

Shade-intolerant — Species of plants that do not grow well in or die from the effects of too much shade. Generally these are fire-tolerant species.

Succession — A predictable process of changes in structure and composition of plant and animal communities over time. Conditions of the prior plant community or successional stage create conditions that are favorable for the establishment of the next stage. The different stages in succession are often referred to as seral stages.

Introduction

The ecosystem conditions presented in earlier sections of this chapter have been influenced or caused by a variety of interrelated factors such as fire suppression, timber harvest, human demographics, insects and disease, roads, livestock grazing, and noxious weeds. Many of these factors influence more than one resource or vegetation type—that is, they create predictable conditions that can affect a number of ecosystem resources regardless of whether the vegetation is forestland, rangeland, aquatic, or riparian area. They also affect each other, and their effects often cannot be separated.

For example, livestock grazing influences the dry forest, riparian, cool shrub, dry shrub, and dry grass potential vegetation groups, but it also influences moist and cold forests for a much shorter time period during the course of a year. Livestock grazing also affects the fire regimes in forests as well as rangelands through disruption of fine surface fuels. Fire regimes in turn influence livestock grazing through effects on vegetation. Roads can influence aquatic and riparian conditions, terrestrial wildlife habitats, and the spread of noxious weeds, which in turn can affect conditions in rangelands, forestlands, and wildlife habitats. Most of the factors operate across subbasins and are landscape-based.

These factors have been discussed as appropriate in individual sections of this chapter with regard to their direct or indirect influence on separate components of the ecosystems of the interior Columbia Basin. This section presents a more integrated discussion of the influence of various factors on ecosystem health in the project area.

Fire and Fire Suppression

Historical to Current Trends

Wildfire has long been a dominant disturbance in the interior Columbia River Basin, affecting succession in the native system. American Indians' use of fire as a disturbance process had an integral role on the landscape over vast areas of the basin for at least the past 2,000 years (Mehringer et al. 1977, Ross 1981, Shinn 1980, and Woods and Horstman 1996). The use of fire substantially augmented the extent and incidence of wildfires, and the effects on the landscape were especially noticeable near grasslands, low-elevation forests, and in or near major valleys or other significant settlement locations, resource acquisition areas; and travel routes (Barrett and Arno 1982). Elsewhere, lightning supplied the ignition source for wildfires that burned frequently in dry forests and moist rangelands and less frequently in moist forests and drier rangelands. Some of the highly variable factors that influenced the natural fire regime in forests and rangelands were extent and water content of fuel, topography, and weather.

Reduced fire occurrence began in the late 1800s as a result of the following: (1) relocation of American Indians; (2) fuel removal by excessive livestock grazing; (3) disruption of fuel continuity on the landscape due to irrigation, cultivation, roads, and community development; and (4) adoption of a fire exclusion policy.

Early in the 20th century, wildfires began to be perceived as dangerous, destructive, and undesirable. Early wildfire suppression efforts were crude but somewhat successful in low to mid elevations because of low levels of fuels, which had been maintained by the predominant fire regimes.

Wildfire suppression activities, aided by improved technology for fire detection, prevention, and suppression, were generally successful in reducing the extent of wildfires from the 1910s through the 1960s. Fuel loadings have steadily increased as a result of suppression efforts and fire frequencies have declined (Agee 1993). As a result, fire size, intensity, and severity have increased, as have suppression costs and the associated hazards to life and property.

The area burned by wildfires in the basin steadily increased between the 1970s and 1990s, even though land managers have been allocating increasing amounts of resources to wildfire suppression. The current extent of wildfires is approaching that experienced in the early 1900s. The average costs of wildfire suppression, number of firefighter fatalities, and extent of high-intensity fires during the past 25 years are double the corresponding levels that occurred between 1910 and 1970. Further complicating matters, human populations within the urban–rural–wildland interface have substantially increased within the past few decades. These areas of rapidly-growing human populations are commonly associated with high fire risks. (See the Urban–Rural–Wildland discussion, later in this section, for additional details.)

Wildfire suppression, in conjunction with other factors, has caused great changes in: disturbance frequency, size, and severity; vegetation structure,

density and composition; and the resulting patches and patterns. These are different from those to which native plant and animal species have adapted. Fire exclusion has caused a shift to conditions with more severe disturbance regimes. Current amounts of fire in these areas are generally less than in the native system, but when current wildfires occur they are much larger in patch size and more severe in their effects compared to the native system. In addition the resistance to control is substantially higher than conditions of the early 1900s. Hann , Jones, Karl, et al. (1997) called this increase in wildfire size, severity and resistance to control, "uncharacteristic wildfire effects" (Map VB14.1).

In the past 100 years, fires have become less frequent and more intense, except in dry grass and dry shrub PVGs that have been invaded by exotic annual grasses, where fire disturbance has become more frequent.

Overview of Fire Suppression Influence

There is little similarity between the historical and current succession/disturbance regimes within forest and rangeland systems. In the past 100 years, fires have become less frequent and more intense (Agee 1993, Gast et al. 1991 in Lehmkuhl et al. 1994). Exceptions to this general trend are the dry grass and dry shrub PVGs that have been invaded by exotic annual grasses. In these instances, fire disturbance has become more frequent.

In forested potential vegetation groups (PVGs), wildfire suppression coupled with timber harvest, introduced pathogens, livestock grazing, and natural succession are responsible for these changes over the past 100 years (Hann, Jones, Karl, et al. 1997). The most notable changes in *forestlands* include:

1. Declines in extent and increasing fragmentation of dry and moist late seral forests, especially single storied;
2. Declines in the extent of early seral forests;
3. Dramatic increases in the extent and connectivity of mid seral forests;
4. Large declines in the shade-intolerant cover types such as ponderosa pine, western larch, western white pine, and whitebark pine, which have become more fragmented; and increases of shade-tolerant forests such as Douglas-fir, grand fir, white fir, and subalpine fir, which have become significantly less fragmented;
5. Overall forest composition and structures largely becoming more homogeneous; and
6. Decline in the number of large trees and snags in harvested and roaded areas (Hann, Jones, Karl, et al. 1997).

In forested PVGs, fire severity has shifted substantially from nonlethal to lethal between the historical and recent past on Forest Service- and BLM-administered lands (Hann, Jones, Karl, et al. 1997). Lack of frequent nonlethal underburns has resulted in increases in fuel loading, an increase in duff depth (up to 24 inches under old trees), an increase in stand density (generally development of dense conifer understories beneath old stands and thickets of small trees where the overstory has been removed), an increase in shade-tolerant species, and fuel ladders that can carry fire from the surface into the tree crowns. In general, the exclusion of fire and extensive harvesting of large, shade-intolerant trees resulted in a shift of forest dominance to smaller, shade-tolerant trees that were more susceptible to wildfire, stress, insects, and diseases (Hann, Jones, Karl, et al. 1997).

Areas dominated by rangeland PVGs also had substantial changes in disturbance regime patterns as a result of wildfire suppression and other factors such as agriculture, excessive livestock grazing pressure, and the introduction of exotic plants. The most notable changes on *rangelands* are:

1. Shifts from all rangeland PVGs, especially dry grass and dry shrub PVGs, to agricultural PVG;
2. Encroachment of woody species such as sagebrush, juniper, ponderosa pine, and Douglas-fir, especially in the dry grass and cool shrub PVGs, which has reduced herbaceous understory and biodiversity;
3. Increased densities of sagebrush in the dry shrub PVG, leading to a decline in the herb and grass understories;
4. In some places, replacement of native cover types by exotic species, increasing soil erosion, simplifying stand structure, reducing biodiversity, and reducing utility to wildlife species; in many locations, the altered fire regime continues the dominance of exotic annual grasses; and
5. Increased fragmentation and loss of connectivity within and between blocks of habitat, especially in the shrub-steppe and riparian areas (Hann, Jones, Karl, et al. 1997).

In rangelands as in forests, these changes in the fire regime have caused greater homogeneity, or simplification, of many landscapes. In dry grasslands where fire typically has been absent, shrubs are more competitive than grasses, in part because shrubs have deeper root systems than grasses, allowing them to tap soil moisture in dry years. This change in disturbance regime caused the shift from herb to shrub or woodland, or from shrub to woodland. When the changes in disturbance regime shifted herblands to exotics, the result was a short-cycle regime, particularly if the exotics were highly-flammable exotic annual grasses. This increased fire frequency has caused a loss of shrub cover, particularly sagebrush and bitterbrush, and reduction in bunchgrasses (Leonard and Karl 1995a, 1995b).

Landscapes that are dominated by a *mosaic of forest and rangeland PVGs* had inherently more diverse disturbance regimes than did forest-dominated or rangeland-dominated landscapes alone. Although the individual landform, potential vegetation group, and succession/disturbance regime relationships and resulting changes to vegetation patterns are generally the same as in the forest-dominated or rangeland-dominated landscapes, the effects at the landscape level are substantially different. The forest–rangeland landscape pattern has many complex ecotonal and disturbance relationships that are further complicated by the spreading influences among its varied environments and communities. In general, the changes that occurred in forest–rangeland landscape patterns have been more substantial than those observed in either the forest or rangeland landscape patterns alone. This is because the energy gradients are steeper, topography is more rugged, the disturbance regimes are more dynamic because of the forest/rangeland mosaic, and the diversity of species is higher with forest–rangeland landscape pattern (Hann, Jones, Karl, et al. 1997).

Specific Influences of Fire Suppresssion

Fire Suppression in the Cold Forest PVG

Cold forests have longer fire intervals than dry or moist forests, so the effects of fire exclusion on forest structure and composition are not as noticeable as in the other forest PVGs. The cold climate and short growing season in cold forests also slow the natural rate of change in vegetation when compared to dry or moist forests. However, some changes from historical conditions have occurred.

Historically, the mixed-fire regime in the cold forest PVG reduced fuels and thinned tree densities, thereby accelerating the growth rate of survivors. Under fire exclusion policies, the fire interval has increased and intermediate nonlethal underburns (which along with stress, insects, and disease, used to thin the forests and accelerate the growth in surviving trees) have been lost. When fires do occur they tend to be larger, lethal, crown-fire events of high intensity (particularly on upland slope environments) because of increased tree densities and fuel loading, both due to wildfire suppression; the changes in the fire regime resulted in changes to landscape structure and composition. Maintenance of dead and downed wood on these sites is important for nutrient cycling; therefore, the severity of wildfires can have long-lasting impacts on soils and site productivity (Hann, Jones, Karl, et al. 1997).

With fire exclusion, more areas of lodgepole pine are in a late seral multi-story structure, a stage more susceptible to outbreaks of mountain pine beetle. This leads to larger areas of mountain pine beetle outbreaks, for longer periods, and often with greater intensity than occurred historically. Increasing size of susceptible stands of trees has also contributed to higher levels of other insects and diseases (Hann, Jones, Karl, et al. 1997).

Historically, shade-intolerant species dominated regeneration and young forest environments. This relationship has been altered, resulting in landscapes that now have mixed dominance or are dominated by shade-tolerant species, such as extensive areas where conifers have replaced or are replacing aspen. This is especially true where fire exclusion have favored the establishment of shade-tolerant species. As a result, many areas are highly susceptible to tree mortality from fire, insects, disease, and stress.

In particular, loss of whitebark pine and alpine larch habitat, due to white pine blister rust and overstocking resulting from fire exclusion, has become a forest health concern in the past ten years (Hann, Jones, Karl, et al. 1997). Fire exclusion has allowed the encroachment of shade-tolerant trees to form dense stands and fuel ladders, and it has precluded the regeneration of whitebark pine seedlings, with immense consequences to cold forest ecosystems. For example, grizzly bears depend on whitebark pine seeds as a major component of their diet because the seeds are large, are a good source of protein, and are available in squirrel caches. What the decline in whitebark pine means to grizzly bears in the long term cannot yet be determined, but grizzly bears are a species of special importance to tribes and are listed under the Endangered Species Act. Other cold forest species of importance to tribes that have been detri-

mentally affected by fire suppression, increased stand density, decreasing shrubs, and large tree components include: blue grouse, spruce grouse, and snowshoe hare.

Fire Suppression in the Moist Forest PVG

The moist forest potential vegetation group has a productive environment which rapidly produces biomass and accumulates fuels. The effective exclusion of almost all nonlethal underburns and a reduction of mixed fires has resulted in the development of dense multi-storied stands with high potential for stand-replacing fires. These highly productive forests have increased amounts of carbon and nutrients stored in woody material, resulting in fires that are of higher intensity and severity. Even where fires do not crown, dominant trees can be killed by consumption of large diameter surface fuels and duff layers. Potential for high amounts of soil heating and death of tree roots and other understory plants is much higher than it was historically.

The current fire regime in the moist forest has become simplified compared to the historical regime. As a result of higher fuel loads, increased stocking levels of trees, and high late summer water stress levels, most of the moist forest PVG shifted to lethal crown fire or mixed fire regimes. With recent fire suppression efforts, the general fire interval has almost tripled. Increasing fire intervals without corresponding fuel reduction, together with the elimination of the thinning effect that historically reduced shade-tolerant trees in the stands, has resulted in higher-intensity fires.

Fire exclusion has led to a decrease in extent of late seral single and multi-story structures and a decline in early seral forest. Mid seral forest has increased, especially the shade-tolerant cover types. Change of potential insect and pathogen disturbances is directly correlated with the change in composition, structure, and connectivity of forest host species. Thus, increases in insect and pathogen disturbances are strongly tied to the increase in shade-tolerant species, dominance of medium to large trees, increased crown cover, development of the understory, and development of multiple crown layers. Causal factors vary geographically by type and intensity of timber harvest, effectiveness of fire exclusion, and the resultant stand structures and composition.

Similar to changes in dry forest systems of the project area, susceptibility to large-scale damage by insect infestations and diseases has increased in many moist forests. Tree density has increased and vigor has decreased in moist Douglas-fir and grand fir forests, making them more susceptible to insect and disease damage.

Tree harvest and white pine blister rust have all but eliminated the western white pine cover type. In its place are Douglas-fir, grand fir, and white fir. This has had a huge impact on the structure and fire ecology of the moist forest, because no other tree species can grow as fast or as tall as, or fill the ecological niche of, western white pine. This affects the usability of habitat for species such as the pygmy shrew, wolverine, Yuma myotis (bat), long-eared myotis, fringed myotis, and long-legged myotis (Wisdom et al. in press). Economically, western white pine is a highly desirable species.

Soil fertility of some sites has been depleted through timber harvest practices or through multiple fires, which displace or erode surface soil or remove much of the large woody material, litter, or duff. Fire exclusion also reduces site productivity, increases the probability of insect and disease infestation, increases the probability of high intensity fires, and changes habitat conditions (Hann, Jones, Karl, et al. 1997). In general, moist forests identified as having the most forest health problems are in areas that have been roaded and harvested. This is because fire suppression has been most effective in roaded areas and consequently changed the vegetation composition and structure within those areas.

With current trends in moist forests, tribes have experienced associated declines in some of the plants that they consider important, such as huckleberry, buffaloberry, and beargrass.

Fire Suppression in the Dry Forest PVG

Current fire regimes in the dry forest potential vegetation group are the least similar to historical regimes of all the forest PVGs. This is partly because dry forests are more accessible to housing developments, logging, and grazing. Dry forests also contain tree species historically favored by the timber market (Everett et al. 1994), and they were subject to disruption of natural fires through suppression activities.

The interval between fires has doubled, tripled, or more. Increasing the intervals without corresponding fuel reductions has resulted in much higher fuel loads and fire intensities than were previously experienced. With the exclusion of fire, stands are often more dense, which means larger amounts of carbon are tied up in woody materials. Overstocked stands

result in moisture stress in the normal summer drought period, and make stands highly susceptible to insects such as bark beetles.

Historically, fires not only favored the regeneration and release of shade-intolerant species by providing openings and bare mineral soil, but they also minimized fuel loads and effectively thinned from below, favoring lower tree densities and drought and disease tolerance. Fires also rejuvenated shrubs in the dry forest. Lack of frequent fire and the resulting dense forests have caused declines in some shrubs that are important to tribes such as mountain mahogany, chokecherry, and serviceberry. Species composition has changed to dominance by trees such as Douglas-fir, grand fir, and white fir. The younger forest structure or multi-storied structure composed of a high proportion of shade-tolerant species is highly susceptible to large-scale infestations of insects and disease (Hann, Jones, Karl, et al. 1997).

Current fire regimes in the dry forest potential vegetation group are the least similar to historical regimes of all the forest PVGs.

Bark beetles currently often replace fire in eliminating trees growing in excess of site potential. Outbreaks of western pine beetle and mountain pine beetle have become more intensive and extensive. Susceptibility to the Douglas-fir beetle has increased in many areas compared to historical conditions. This can be attributed to increased spread of shade-tolerant Douglas-fir, increased abundance of host trees of adequate size for successful bark beetle breeding, increased patch densities and layering of canopies, and increased landscape contiguity of susceptible areas. Susceptibility to fir engraver beetle has increased in many areas because of expansion of grand fir and white fir and expansion of multi-layered understories. Spruce beetle activity appears to be correlated with the drought of the past eight to nine years (Hann, Jones, Karl, et al. 1997).

Increasing susceptibility to Douglas-fir dwarf mistletoe was associated with increased abundance of Douglas-fir, increased canopy layering, and Douglas-fir encroachment on dry and relatively moist sites that historically had frequent understory fires. Increases in susceptibility to root diseases are associated with effective fire exclusion, the selective harvest of shade-intolerant species, and the contagious spread of Douglas-fir and true firs in dense, multi-story arrangements (Hann, Jones, Karl, et al. 1997).

The increasing number of small dead trees in stands attacked by insects and diseases makes forests even more susceptible to large high-intensity fires. The stands that are most susceptible to moisture stress, insects, and disease tend to be those at the lowest elevations, which typically border private, state, tribal, or other land ownerships. The clumpy character of historical stands that was created by fire has changed. Overall, stand structures changed from open park-like stands of large trees with clumps of small trees, to dense overstocked young stands with several canopy layers (Caraher et al. 1992, Gast et al. 1991 in Lehmkuhl et al. 1994). As dry forests become denser, moisture and light become more limiting and openings less common, and tribes have seen declines in plants that they consider important, such as chokecherry, serviceberry, bitterroot, and biscuitroot.

Fire exclusion effects have been greatest in the most heavily roaded areas where suppression has been successful. Development of residential areas and other cultural facilities in project area forests has been most common in this PVG, which, coupled with the changed fire regime, has caused a greatly increased risk to life and property. Homes, private, tribal, and state forest resources, wildlife winter ranges, and other important resources are increasingly at risk from fire and insect and disease attack from lands administered by the BLM and Forest Service (Everett et al. 1994).

Fire suppression has helped to shift habitats away from species that require open stands and to favor those species needing dense stands. Species that require late seral habitats—such as whiteheaded woodpecker, white breasted nuthatch, and western gray squirrel—are finding habitat scarce in much of the basin, while species that can use mid seral structures have an abundance of habitat. However, fire suppression has also resulted in a reduction of early successional stages so these habitats are still in short supply in many areas. Large, intense fires have also created substantial amounts of habitat for snag-dependent species; however, this increase is short-lived and fires may lead to long-term shortages of snags over large areas. The increased intensity of fires can have adverse effects on litter and downed wood, which can have adverse effects on amphibians. Within burned areas, mosaic patterns of habitat and unburned islands of vegetation have decreased, probably limiting the distribution of less mobile species.

Fire Suppression in the Cool Shrub PVG

Current fire regimes in the cool shrub potential vegetation group are the closest to historical of all of the rangeland PVGs. Generally, fire regimes have decreased in frequency and increased in intensity, resulting in a decline in extent of upland herblands and upland shrublands and an increase in extent of upland woodlands. Juniper woodlands have greatly expanded at the expense of both upland herbland and upland shrubland, hastened by excessive livestock grazing pressure. The expansion of western juniper is causing decreases in understory productivity, decreases in diversity, changes in the hydrologic cycle, and habitat conversion. Habitat is changing in favor of such species as ash-throated flycatcher, bushtit, and spotted bat, at the expense of species such as ferruginous hawk, burrowing owl, and lark sparrow.

When woodland encroachment occurred, fuels accumulated and communities exhibited high stress and low foliage moisture. During drought years, very intense fire events had the potential to occur in woodlands, and often caused relatively severe effects on the soil surface and mortality to the understory grasses and forbs. Today, the upland herblands in the cool shrub PVG has been nearly eliminated. Under the current dynamics, the cool shrub PVG is susceptible to invasion by exotic weed species that could eventually dominate at least two percent of the PVG (Hann, Jones, Karl, et al. 1997).

The increase in density and extent of western juniper woodlands has had beneficial effects as well, such as to several wildlife species. Western juniper is important to and used extensively by tribes.

Fire Suppression in the Dry Shrub PVG

Averaged for the entire dry shrub group, the current fire regime has not changed much from the historical regime. However, fire frequency has increased in locations where exotic annual grasses have invaded, and it has decreased elsewhere. Throughout the dry shrub PVG, fire severity has increased since historical times (Hann, Jones, Karl, et al. 1997).

In those areas where fire frequency has *decreased*, trees (in the absence of fire) can invade dry shrub areas that lie adjacent to woodland or dry forest areas. Tree establishment in the dry shrubland PVG disrupts the established nutrient regime. Tree species tie up nitrogen and other trace nutrients, thereby decreasing overall site productivity. Subsequently, foliage cover, basal cover, and litter from shrubs, grasses, and forbs decline, thereby exposing surface soil and increasing erosion potential. Erosion is potentially aggravated by excessive grazing pressure from livestock and big game. Once the surface soil is eroded and the subsoil exposed, the environment is more conducive to tree species that are more competitive for sub-soil moisture (Hann, Jones, Karl, et al. 1997).

When woodland encroachment occurs, fuels accumulate and communities exhibit high stress and low foliage moisture. During drought years, very intense fire events can occur in areas of woody encroachment, often causing relatively severe effects to the soil surface and mortality to the understory grasses and forbs.

In those areas where fire frequency has *increased*, the eventual result is mortality of perennial species and prevention of their recruitment because most perennial vegetation in the dry shrub PVG is not adapted to more frequent, high-intensity fires. Hann, Jones, Karl, et al. (1997) expect an expansion of this shift in fire regimes over the next 50 years. Such an expansion will convert even more of the dry shrub PVG to annual exotic grasses, which can result in altering ecosystem processes (Vitousek et al. 1996) because the additional abundance of fine, flash-type fuels, combined with sagebrush fuels, creates intense fires. Some of the potentially altered processes include primary productivity, decomposition and nutrient cycling, hydrology, and disturbance regimes.

For example, cheatgrass, an annual grass, is well adapted to frequent fire regimes. Standing cheatgrass and litter produced by cheatgrass are extremely flammable, so cheatgrass helps to maintain the frequent fire return intervals (Billings 1948) in places where they did not occur before. Pellant (1996) calls this the "cheatgrass–wildfire cycle." (See discussion of cheatgrass, later in this section, for additional details.)

As a result of the cheatgrass-wildfire cycle, big game winter range has declined, habitat supporting the densest population of nesting raptors in North America has declined, the persistence of native plants is threatened, non-game bird abundance has declined, native species richness has declined, successional recovery periods have been extended, and presence of biological crust organisms has declined (Hann, Jones, Karl, et al. 1997). Declining species important to tribes in the dry shrub PVG are the jackrabbit, pygmy rabbit, sage grouse, and sharptailed grouse.

Fire Suppression in the Dry Grass PVG

Because of fire suppression and excessive livestock grazing pressure, fire intervals in the dry grass potential vegetation group have increased, as have overall fire intensities. Fuels generally did not increase on the upland herblands because they typically were grazed, but the vigor of the dominant grasses and forbs decreased in these types because of the continued absence of fire. Fuels accumulate when shrubland and woodland encroachment occurs. During drought years, very intense fire events can occur in areas of woody encroachment, often causing relatively severe effects on the soil surface and mortality to the understory grasses and forbs. Effects of increased fire intensities include decline in presence of biological crust organisms in the dry grass PVG (Hann, Jones, Karl, et al. 1997).

Fire Suppresssion in Riparian PVGs

Within riparian woodlands, the abundance of mid seral vegetation has increased while the extent of late and early seral structural stages has decreased, primarily because of fire exclusion and harvest of large trees. Within riparian shrublands, there has been extensive spread of western juniper and exotic grasses and forbs. Overall, there has been a decrease in large trees and late seral vegetation in riparian areas (Lee et al. 1997).

This change in habitat has had detrimental effects on the silver-haired bat, the hoary bat, the northern flying squirrel, and many other species. Lack of fire, along with excessive livestock grazing pressure, has been a factor in the decline in willows and cattails, which are important to tribes.

Fire Suppression in Aquatic Areas

Present aquatic systems in the basin have evolved in response to and in concert with wildfire. The effects of fire on aquatic systems may be direct and immediate (for example, increased water temperature, or chemical input) or indirect occurring over an extended period, but ultimately fire results in a natural mosaic of habitats and populations. The intensity and scale of these effects are related to the size and intensity of fire, geology, topography, size of the stream system, and amount, intensity, and timing of subsequent precipitation events (Lee et al. 1997).

Physical properties of soil that influence water retention are altered by heating. In some cases, soils become water repellent after severe burns (McNab et al. 1989). The amount of vegetation remaining in a watershed after a fire directly influences runoff and erosion by physically mediating the force of precipitation on soil surfaces, altering the evapotranspiration cycle, and providing soil stability through root systems. Runoff rate and pattern and subsequent erosion potential are directly affected by the amount of organic debris left in the watershed (Lee et al. 1997). According to Wells et al. (1979 cited in Jensen et al. 1997), intense fire can have four generally negative impacts on soils:

1. Removal of protective surface layer organic materials;
2. Volatilization of large amounts of nitrogen and smaller amounts of other nutrients;
3. Conversion of some nutrients into soluble forms that can be lost by leaching; and
4. Heating of the soil and alteration of its physical, chemical, and biological properties. In general, the hotter the burn the greater the potential for soil damage and nutrient loss (Jensen et al. 1997).

The main effects on aquatic habitats from more intense fire regimes in the uplands and riparian areas compared to historical times come from more thorough consumption of ground cover that would protect the soil against rain, wind, and overland flow; more thorough killing of the overstory and understory plants that would stabilize the soil; and intense fire conditions over more of the landscape. The result is more sedimentation and degradation of aquatic habitats than the aquatic species evolved with, spread over a larger area. There is an increased risk of mass sedimentation events until watershed soils have time to stabilize and vegetation has time to recover following a wildfire. In cases where plant and animal populations are severely affected, there is less opportunity for surrounding populations to re-invade the habitat because the wildfires are often uncharacteristically extensive (Lee et al. 1997).

In the basin currently, recreational fishing and to a lesser extent commercial fishing have important economic values. In addition, fish (especially salmon) are extremely valuable to many tribes in the project area for economic, nutritional, and spiritual reasons (McCool et al. 1997). It is estimated that the true effects of wildfire suppression on fisheries resources have appeared only in the past 20 to 30 years, and that they may have only played a small role in the decline of aquatic species. However, it is felt that

such effects are becoming more prominent, setting the stage for more severe wildfire effects on aquatic resources in the future (Hann, Jones, Karl, et al. 1997).

Fire suppression has changed the character of vegetation and thereby has contributed to altered timing and volume of stream flow, by changing on-site hydrologic processes (Wright et al. 1990). On rangelands, fire suppression is partly responsible for expansion of western juniper (see earlier discussion), which combined with increasing density can result in decreased understory vegetation (Karl and Leonard 1995); this is believed to contribute to decreased soil infiltration and increased peak discharges during intense rainfall. In forested environments, increased above-ground vegetation due to fire suppression also may have resulted in increased evapotranspiration rates and decreased runoff. Where high intensity fires have increased because of fire suppression, soil porosity has decreased, thus increasing runoff and soil erosion (McNabb and Swanson 1990). Fire can also cause water-repellent layers to form in soils, resulting in temporarily increased runoff (DeBano et al. 1976).

The quality and quantity of water directly influences the lands and resources associated with the rights and interests of tribes, such as instream flows, pools, turbidity. Wildfire suppression has resulted in deteriorating effects on water quality in some parts of the basin especially in the past few years, and the risk is increasing.

Fire Suppression and Air Quality

Clean air and good visibility contribute to the quality of life for people living in the project area and may contribute significantly to the quality of the experience for people who come to the basin to recreate or earn a living (McCool et al. 1997). Wildfires currently have a significant impact on the air resources, degrading ambient air quality and impairing visibility. Because of altered fire regimes due to fire suppression, the area burned by nonlethal understory fires is only one-third of that which burned historically. Stand-replacing fires consume more fuel and produce more smoke than nonlethal fires, which usually burn with fairly low surface fire intensities in the understory. Brown and Bradshaw (1994) found that emissions are greater from current fires, even though they burn fewer total acres than historically, because consumption of fuel per unit area burned has been greater in the current period. Coupled with greater fuel loads in today's forests due to fire suppression, the potential for smoke from wildfires is immense. Inversions during summer are a major cause of the worst ambient air conditions associated with wildfires in the project area.

The effects of poor air quality from wildfire smoke are preventable only through prescribed fire or other fuel reduction activities. Once a wildfire is out of control the smoke is not manageable. Smoke from wildfires can be hazardous to public health, dangerous to travelers, and detrimental to scenic quality.

Fire Suppression and Human Uses

Wildland fire management on Forest Service- and BLM-administered lands will likely become more challenging in the future, because costs of fire prevention and suppression are escalating and effectiveness seems to be declining. Human populations within the urban–rural–wildland interface have substantially increased within the past few decades. These areas of rapidly growing human populations are commonly associated with high fire risk (Hann, Jones, Karl, et al. 1997).

Humans attach emotional, spiritual, and symbolic identification to places—often referred to as a "sense of place," where natural resources are valued not only for functional purposes but also for their value as places to which people, as a community, are attracted and become attached. Altered fire regimes due to fire suppression can have impacts on people by altering the places that have attachment values.

Scenery—the general appearance of a place and the arrangement of its individual features—is another type of amenity provided by federal lands in the project area. Human intervention in natural processes such as fire suppression has been a significant force in shaping visual quality. High scenic integrity is generally considered to occur where native visual qualities are intact and the landscape is unspoiled by human intervention (McCool et al. 1997). As the potential for uncharacteristic wildfire increases in the project area, the potential to reduce visual integrity also increases, since the sight of severe wildfires on the landscape is not considered pleasing to many tourists and residents.

Stand-replacing wildfires that result from past fire suppression often provide an opportunity for salvage harvest in forested environments, which can lead to local economic benefits in the short term. However, such fires decrease harvest opportunities in the long term and reduce the predictability of forest product outputs.

Timber Harvest

Historical to Current Trends

The biophysical environment influences people, their actions, and their systems (social, cultural, economic, political). In turn, people through their actions affect the biophysical environment. Subsequently, human-caused changes in the environment lead to modification of peoples' actions and, potentially, their systems. The continuing cycle represents the working of adaptive management across all scales.

One example of this cycle is the traditional harvest of timber. Euroamerican settlers coming into the basin in the 1800s were initially drawn by the natural environment—an area rich with resources, such as space to live in, raw materials to create shelter and food, and products that could be used to make a living.

Euroamerican settlers brought a cultural system that encouraged domination and use of the natural environment. They brought tools and processes to facilitate that cultural system. They also brought knowledge of and connections to distant markets that had demands for resources from the basin: furs, timber, minerals, meat, and farm products. As a result, within the span of just a few decades, Euroamerican settlers and their descendants had significantly affected the biophysical environment of the basin.

From the late 1800s to the latter 1900s, millions of acres of timber have been harvested. Impacts on the surrounding environment generally were the result of actions to support families and engage in economically rewarding production of goods and services that were desired by the American people. People were directly employed as proprietors or employees in the processes of timber harvesting, milling of lumber, wood products manufacturing, pulp and paper making, use of wood for energy, providing wood to railroads for ties and trestles, providing timbers for mines, and selling other wood products (such as posts, poles, and beams).

As timber harvest businesses proved successful, other people were employed in supporting businesses, trade, and government services (Haynes and Horne 1997). Communities and companies were established and have flourished because of the timber industry. In Idaho, for example, employment of loggers, rafters, and sawmill workers increased from just over 300 in 1880, to more than 8,000 in 1920, to 14,900 in 1995. From 1945 until 1970, timber harvest on federal lands in the project area increased about five percent per year (McCool et al. 1997).

Overview of Timber Harvest Influence

Over the years, timber harvest generated effects in addition to impacts on employment. Timber harvest and forest management practices, along with wildfire suppression, have changed disturbance regimes, natural succession, and vegetation patterns. Roads built to access timber have led to secondary effects, some harmful and some beneficial. For example, roads have caused human disturbance to many terrestrial wildlife species and degraded aquatic species habitat through sedimentation. They have also provided travel routes for other economical and recreational purposes.

The net increase of mid seral forests and the net declines of early seral and late seral forest communities were most likely due to a combination of fire suppression and timber harvest activities throughout the project area. Timber harvest activities reduced the extent of late seral forest communities, while fire suppression activities limited the recruitment of early seral forest communities. Consequently, middle-aged forests now dominate the distribution of terrestrial communities in forested environments more than they did historically.

The rate of change was greater in lower montane than in subalpine forest communities because natural disturbance frequencies within the lower montane were greater than those of the subalpine. Also, successional rates were slower in the subalpine environments. Consequently, the effects of altering disturbance regimes accrued much faster in lower montane environments. In addition, human settlement tended to concentrate in the lower elevation, more hospitable environments. This brought with it the effects of human settlement, development, and uses. Agriculture, urbanization, livestock grazing, fire suppression, and timber harvest in the project area have all had significantly greater impacts over a relatively longer period of time on lower montane forests than on montane and subalpine forests.

Some ecological benefits were derived from timber harvest that otherwise could only have been achieved through a frequent low intensity disturbance. For instance, a harvest thinning can reduce fuel loading and overstocking of trees which, before fire suppression, was accomplished through frequent low intensity fires. These objectives, however, were not often considered important.

From the earliest days of timber harvesting in the project area, the preferred species to harvest were the more valuable shade-intolerant trees such as ponde-

rosa pine, western white pine, and western larch. Of course the largest trees also provided more profit. Of the western white pine cover type that was fairly extensive in the moist forest PVG in the northern parts of the basin at the time of settlement, 95 percent has been eradicated by timber harvest and white pine blister rust.

The result of timber harvest in the low to mid elevation forests is that late seral forests were converted to shade-tolerant mid seral forests through selective harvest of the oldest shade-intolerant trees, or converted to early seral forests through clearcutting or harvest and wildfire. In the case of western white pine, it was often replaced with grand fir, western hemlock, or Douglas-fir. This is an important reason for declines in wildlife species that need late seral forest habitat, such as white headed woodpecker, white breasted nuthatch, or western grey squirrel. It also relates to altered fire regimes, because large shade-intolerant trees are most tolerant of fire and adapted to a regime of frequent, low intensity disturbances.

In the latter part of this century, timber harvest coupled with tree planting greatly speeded up the forest regeneration process, reducing the length of time the forest stayed in the early seral stage. Less early seral forest has meant fewer wildlife species that depend on this habitat, such as Lazuli bunting (Wisdom et al. in press). Reforestation practices have also reduced early seral forest by changing the structure through removal of remaining emergent trees and snags and by shortening the time it takes a stand to move through the stand-initiation stage. Some wildlife species appear to be sensitive to the planting of uncharacteristically high numbers of trees; artificially dense forest stands create unsuitable habitat.

Fire suppression in conjunction with timber harvest allowed mid seral forests to become dense and filled with shade-tolerant species. This combination of management practices also caused the remaining late seral single story forests to develop multiple canopy layers. Early overgrazing by livestock also aided in the process of increased forest stocking in the low to mid elevation forests. One of the effects of increased forest densities has been a reduction in forbs and grasses in the understory used as forage by large game and livestock. On the other hand, large game have found an abundance of hiding cover in these forests. Deer and elk populations have improved with the current mix of habitats in the project area, which has been beneficial for tribes and other people who hunt large animals.

Timber harvest activities have also affected tribes in other ways. American Indian populations in the project area have experienced adverse effects on their way of life and resource uses, some of which was due to timber harvesting. Timber harvest activities and associated roads have produced sediment that has decreased water quality and degraded habitat for salmon and other aquatic species important for economic, nutritional, and spiritual reasons.

American Indians have long used native plants for a wide variety of needs such as food, medicine, incense, lodging materials, and craft materials. Hundreds of native plant and animal species developed cultural importance through subsistence, spiritual, and commercial uses (McCool et al. 1997). These traditions continue today. Increasing forest densities in the low and mid elevations have led to local declines in plant species that are important to tribes such as huckleberry, elderberry, chokecherry, and serviceberry.

Timber harvest can also have direct adverse effects on terrestrial species. The significant declines in old forests throughout the basin and their replacement with mid seral stands, has led to fragmentation of the old forest habitats that remain, which causes a shift in wildlife species composition and vegetation composition. Salvage of dead trees has also reduced the number of snags and amount of downed wood in managed stands.

From settlement time to the present, the amount of soil in the project area disturbed by land management activities has generally continued to increase. Timber removal has at times caused loss of soil organic matter, displacement of topsoil, and compaction of soils, leading to slower infiltration rates, erosion on steep slopes, and disruption of important biological activities. Traditional management activities such as timber harvest, excessive livestock grazing, and roads can directly affect the soil by lowering its long-term productivity, through reducing the soil's capacity to store nutrients and water. This leads to exclusion of fire, invasion of exotics, and development of plant communities on soils that are incapable of supporting increases in biomass. These communities often develop carbon or water stresses and are very vulnerable to wildfire. Nutrients become bound in the woody tissues and are subject to volatilization from severe wildfire. Thus, decline in long-term soil productivity may result.

When uncharacteristic amounts of soil erosion reached streams, it caused degradation of aquatic habitats and resources. Harvest of trees in riparian areas has caused increases in water temperatures. In addition to salmon, many other native fish species have declined since the Euroamerican settlement of the basin, including bull trout, Yellowstone cutthroat trout, westslope cutthroat trout, redband trout, and steelhead. Timber harvest, excessive livestock grazing

pressure, uncharacteristic wildfire, water diversions, fishing, introduction of non-native species, urbanization, hydroelectric dams, and agriculture are the causes of these declines.

The increase in insect and pathogen disturbances can be directly correlated with the change in composition, structure, and connectivity of forest host species. Shade-tolerant trees tend to be more susceptible to insects and disease, and the multi-story structures are conducive to spreading infestations. Not surprisingly, causal factors vary geographically by type and intensity of timber harvest, fire exclusion, and subsequently, the resultant stand structures and composition.

Urban–Rural–Wildland Interface Factors

Fire Risk in the Interface

American Indians used fire for their benefit and protection. In low and mid elevation forests, frequent low intensity fires gave fuels little time to build up between fires. Without excessive livestock grazing pressure, rangelands produced enough fuels to support light fires on a frequent basis. Prior to fire suppression activities, fuels were generally maintained at relatively low levels, and areas having high fuel loads were restricted to relatively small isolated patches.

Since settlers imposed fire suppression, live and dead fuels have accumulated throughout much of the forests in the project area. As access to wildlands increased and mechanical equipment and air support became more available, areas burned by wildfire declined through the 1960s. However, by the 1980s, fuel accumulations had generally increased, and areas having moderate to high fuel loadings became larger and more contiguous. In addition, highly flammable noxious weeds were introduced into the rangelands and low elevation forests. Today the occurrence of uncharacteristically large and severe fires has increased substantially.

Human ignitions increased and so did the expansion of urban and rural development into the wildland interfaces. By 1990, the population of the basin had grown to almost three million people, with nearly half the population living in 12 of the 92 counties in the project area. The basin remains far more rural than the U.S. as a whole, but in many areas population growth and development can threaten the qualities that make wildlands attractive for recreation, retirement, and new businesses, particularly because the risk from wildland fire is increasing in urban and rural places alike (McCool et al. 1997). As wildfires become more severe, the associated hazards to life and property will likely increase, as will wildfire suppression costs, making wildfire management on BLM- and Forest Service-administered lands increasingly challenging (Hann, Jones, Karl, et al. 1997).

In low- to mid-elevation forests, urban areas continue to encroach on wildlands even as the fire danger in the forests continue to increase.

In low- to mid-elevation forests, urban areas continue to encroach on wildlands even as the fire danger in the forests continue to increase. Even outside of urban areas, houses, cabins, and small towns are experiencing an increased risk from wildfire. Many forests are becoming more dense, developing multiple crown layers (including smaller trees that create fuel ladders), and converting to shade-tolerant and less fire-adapted species because of past fire suppression, timber harvest, excessive livestock grazing pressure, road building, and other factors (Hann, Jones, Karl, et al. 1997). In rangelands the fire risk stems from increased density of sagebrush and/or juniper in some places, flash fuels created by cheatgrass or other exotic grasses, and other vegetation and fuel accumulation in the absence of grazing. In both forests and rangelands, when fine fuels dry out in the summer, a spark or other ignition source is all that is needed to start a wildfire, and where there is a lot of human activity, there is an abundance of ignition sources.

Smoke is a byproduct of wildfire. When wildfires burn they can create unhealthy levels of smoke in urban areas or other places inhabited by people. Smoke can also put haze in the way of scenery or cloud vistas. When smoke fills the skies, tourists, old people, young people, and those with respiratory problems suffer. Smoke from wildfires is essentially unmanageable. Smoke from prescribed fires, on the other hand, can be created in manageable quantities at times when winds will carry it away from urban area. Smoke from wildfire often comes without warning, while prescribed fires are planned and can be publicized. (See the Fire Suppression and Air Quality discussion, earlier in this section, for additional details.)

Wildlife Conflicts in the Interface

Many species are vulnerable to urbanization because of changes or reductions in available riparian or other habitats, including those brought on by large reservoir construction. Conversion to agriculture and housing development have affected most wildlife species associated with grasslands and shrublands; even though the vast majority of conversions have occurred on private land, their effects are widespread.

Increased conflicts with wildlife have occurred in the urban–rural–wildland interface. Big game species often run into conflict with people and livestock when habitat is reduced or affected by roads. Many urban areas have expanded into the winter ranges of mule deer and elk in recent years, sometimes resulting in animal damage to private property (such as gardens, ornamental plants, or crops) and sometimes causing declines in wildlife populations because of lack of winter forage. Other species such as mountains lions and coyotes are increasing in the urban–rural–wildland interface and causing concern for human safety. These wildlife species are important to tribes, other hunters, and wildlife watchers. Other tribally important wildlife species that have been affected by urban expansion into wildlands include the sage grouse, jackrabbit, and furruginous hawk.

From an aquatic standpoint, urbanization pressures, river channelization, pollution, and other impacts from an increasing human population became evident by the 1960s, as numerous stocks of salmon, steelhead, and sea-run cutthroat trout declined.

Urban expansion into the urban–rural–wildland interface also has affected the availability of traditional plant species to American Indians and their access to those plants.

White Pine Blister Rust

White pine blister rust is a fungal disease that causes branch and stem cankers that often girdle the stem, causing top kill and/or death to the tree. It is the primary introduced disease that has changed successional pathways, cover types, and structures of the cold and moist forest potential vegetation groups. Large changes from historical moist forest vegetation composition, structure, density, patch and pattern, and disturbance regimes are attributable to the effects of white pine blister rust, harvest activities, fire exclusion, and roads.

Since the settlement of the basin, the western white pine cover type has declined by 95 percent throughout its range in the project area (north Idaho, Washington, and Montana) where there is a combination of climate, abundance of *Ribes* (the alternate host), and susceptible trees (Hann, Jones, Karl, et al. 1997). Another effect of blister rust is poor regeneration of western white pine.

The effects of blister rust go beyond the loss of western white pine, because western white pine fills a unique niche in the ecosystem. Western white pine is a fast-growing, shade-intolerant species that historically depended on fire to remove competing shade-tolerant conifers and to help it regenerate (Graham and Grimm 1990). The loss of western white pine has resulted in a conversion to species such as western hemlock, grand fir, and Douglas-fir. Fire exclusion allowed the forests to become denser, with more canopy layers, smaller trees that create fuel ladders, accumulation of fuels, and trees that retain lower branches. This change has led to less diversity in the understory. It has also changed the disturbance regime to be more severe and reduced the productivity of the ecosystem (Hann, Jones, Karl, et al. 1997). Economically, the residents of the basin have essentially lost a valuable crop to this introduced disease. Wildlife species that need large trees and snags have lost habitat. Examples include the pileated woodpecker, American marten, and northern flying squirrel (Wisdom et al. in press).

White pine blister rust has had a substantial effect in the cold forest PVG as well. Blister rust has reduced the vigor or killed whitebark pine, and the effects are more severe in cold forest than in the moist forest (Hann, Jones, Karl, et al. 1997). The cold climate and short growing season in cold forests slow the natural rate of change in vegetation when compared to dry or moist forests, and the extent of whitebark pine regeneration has declined by 90 percent since the historical period. This leads to concern for high elevation forests of the future.

Hydrologically, loss of scattered whitebark pine trees sometimes causes a disruption of snow pack patterns. Other forest health concerns have been raised because of lower productivity, higher probability of insect and disease infestation, higher probability of high intensity fires, and changes in habitat conditions (Hann, Jones, Karl, et al. 1997).

Some of the wildlife species that need whitebark pine habitat are the Clark's nutcracker and grizzly bear. Grizzly bears in high elevations depend on whitebark pine seeds for a substantial portion of their protein and calories as they build fat to carry them through the winter. Grizzly bears are one of the many species important to tribes.

Roads

Historical to Current Trends

Roads have helped to change the face of the interior Columbia Basin. Some of the earliest roads in the basin were trails traveled by Native Americans. These were expanded by early trappers and prospectors. With the development of the Oregon Trail came a large influx of immigrants to the basin and the beginning of non-native settlement of the project area.

Roads provided the access needed to take advantage of the basin's rich resources: minerals, timber, rangeland, wildlife, fish, recreation, scenery, areas of solitude, and more. Roads have been instrumental not only for the Euroamerican settlement of the basin, but also for the subsequent boom in population, economic expansion, commerce, recreational uses, and the growth and nature of contemporary society. As the number of roads has increased throughout much of the project area, the effects of those roads have also expanded.

Specific Influences of Roads

This section focuses on influences of roads on the ecosystem. Access aspects of roads are described in the Social-Economic-Tribal section , earlier in this chapter.

Streams and Aquatic Species

Roads contribute to the disruption of hydrologic function and increase sediment delivery to streams. Sediment from roads has negatively affected the water and resources dependent on good water quality and quantity, which are important to tribes, communities, recreationists, irrigators, hydropower users, fishermen, and others. The problem is accentuated when roads are old, in sensitive terrain, abandoned, or otherwise not well maintained; roads in conjunction with wildfire add further complications. In general, the closer a road is to a stream, the greater the sedimentation problem.

Roads also provide access for activities such as fishing, recreation, timber harvest, livestock grazing, and agriculture, which have associated effects. In Lee et al. (1997), roads are used as a catch-all indicator of human disturbance on aquatic and riparian systems. Examples of fish species that have declined, in part because of road impacts on aquatic habitat, are Yellowstone cutthroat trout, westslope cutthroat trout, and bull trout (Lee et al. 1997).

Terrestrial Species Habitats

A wide variety of road-associated factors can negatively affect habitats and populations of terrestrial vertebrates as well. Roads are often associated with the effects of human disturbance, which is facilitated by providing access. The density of roads varies greatly across the basin. Existing knowledge about species–road relations was summarized by Wisdom et al. (in press) for the 91 broad-scale species of focus. They identified 13 factors, consistently associated with roads, that can have a negative effect on vertebrates (Table 2-33). At least one of the 13 road-related factors affects over 70 percent of the 91 broad-scale species of focus. In addition, 33 of the 40 groups of species and 11 of the 12 Terrestrial Families have at least one species that is negatively affected by roads.

The negative factors associated with roads are diverse and not always easily recognized. However, several generalizations about effects are possible. Road construction can convert areas of habitat to non-habitat. Roads can provide an avenue for the spread of exotic weeds. Roads create habitat 'edge', which favors species that use edges, often at the expense of species that require more interior habitat. Removal of snags for fuelwood increases along roads. Roads may increase wildlife mortality, through legal and illegal shooting or trapping, vehicle accidents, or poisoning. Roads may increase harassment of species. Roads may restrict movements of small mammals.

Because of these factors, source habitats are probably under-used by many species in areas with moderate or high densities of roads. Furthermore, the negative impacts from roads may exacerbate the negative effects associated with reduction in source habitat. Mitigating the negative effects of roads is challenging, because it requires effective control of human access while balancing societal wants for access and for products (such as recreation, livestock grazing, timber harvest, and minerals) from public lands.

Table 2-33. Road-associated Factors Negatively Affecting Terrestrial Species and Habitats.

Road-associated Factor	Effect of Factor in Relation to Roads
Snag reduction	Reduction in density of snags and/or area where snags are present due to removal near roads, as facilitated by road access.
Downed log reduction	Reduction in density of logs and/or area where logs are present, due to removal near roads, as facilitated by road access.
Habitat loss and fragmentation	Loss and resulting fragmentation of habitat due to establishment and maintenance of roads and road rights-of-way.
Negative edge effects	Specific case of fragmentation for species that respond negatively to openings or linear edges created by roads (such as "habitat-interior" species).
Overhunting	Non-sustainable or non-desired legal harvest by hunting, as facilitated by road access.
Overtrapping	Non-sustainable or non-desired legal harvest by trapping, as facilitated by road access.
Poaching	Increased illegal shooting or trapping of animals, as facilitated by road access.
Collection	Collection of live animals for human uses (for example, amphibians and reptiles collected for use as pets), as facilitated by the physical characteristics of roads or by road access.
Harassment or disturbance at specific use sites	Direct interference of life functions at specific use sites due to human or motorized activities, as facilitated by road access (for example, increased disturbance of nest sites, breeding leks, or communal roost sites).
Collisions	Death or injury resulting from a motorized vehicle running over or hitting an animal on a road.
Movement barrier	Preclusion of dispersal, migration, or other movements as posed by a road itself or by human activities on or near a road or road network.
Displacement or avoidance	Spatial shifts in populations or individual animals away from a road or road network in relation to human activities on or near a road or road network.
Chronic, negative interactions with humans	Increased mortality of animals (such as euthanasia or shooting of gray wolves or grizzly bears) due to increased contact with humans, as facilitated by road access.

Source: Adapted from Wisdom et al. in press, Vol. 1, Table 13.

Exotic Plants

Roads have provided vast avenues of expansion for exotic plants, whose introduction and expansion have drastically affected large areas of habitat. Cheatgrass, for example, cures out in early summer and provides limited forage value compared to native species. Exotic plant expansion has also simplified many plant communities restricting the niches available for many terrestrial animals. The result is loss of productivity, loss of native community structure, loss of native species diversity, loss of habitat, and in extreme cases, changes in the predominant succession/ disturbance regimes (Hann, Jones, Karl, et al. 1997).

Vegetation Succession/ Disturbance Regimes

Roads have contributed to the increased departures of vegetation from historical conditions, especially in the lower to mid elevations, where the greatest concentration of roads are located. Through access for timber harvest, livestock grazing, agriculture, and more effective wildfire suppression, road construction has been a partner in the expansion of mid seral shade-tolerant forests at the expense of late seral shade-intolerant forests and to a lesser extent at the expense of early seral forest in the project area. Fire exclusion

has also been more effective in roaded areas, consequently changing composition, density, and structure within those areas (Hann, Jones, Karl, et al. 1997). In rangelands, road construction has aided in the expansion of woody species through indirectly assisting fire suppression and livestock grazing. These departures of vegetation have created an imbalance of habitats in the project area: habitat scarcity for those terrestrial species that need late seral forest conditions (such as white headed woodpecker, white breasted nuthatch, and western grey squirrel) and abundance of habitat for those that do well in mid seral forests (such as mule deer and elk; Wisdom et al. in press).

Many forests that have been identified as having forest health problems have been roaded and harvested. In general, wildfires are becoming larger and effects are becoming more uncharacteristically severe because of timber harvest, fire suppression, and roading.

Snags and Downed Wood

There is a high correlation between the high density of roads and the reduction of large snags and coarse woody debris. Snags and downed logs are important components of forest and woodland ecosystems. They provide essential habitat for wildlife, invertebrates, fungi, bryophytes, lichens, and other organisms. They store carbon and nutrients and provide site improvement following extreme disturbance. Snags and coarse woody debris are closely tied, because snags are a future sources of downed logs and coarse woody debris, which recycle nutrients and provide habitat for both plants and animals. Large diameter snags are especially valuable to a wide array of species because they offer greater surface area, more opportunity for cavities, and greater longevity. Hann, Jones, Karl, et al. (1997) found that snag and coarse woody debris levels have declined in roaded and harvested areas.

Tribes

For tribes in the project area, roads have resulted in both positive and negative changes to the current condition of resources important to individual tribes. While roads have increased tribal access to the resources and lands they use, they have also provided greater access to other people. Increased access has led to greater disturbance to cultural and historical resources and increased user conflicts. Recreationists and recreational uses of public lands have increased, resulting in growing conflicts with tribal uses, some of which are referenced and guaranteed under treaties (such as fishing, hunting, trapping, and gathering). Examples of recreational or commercial-type uses which can conflict with tribal uses or which can negatively affect resources important to tribes are: commercial raft and float trips, 'new-age' activities, rock climbing, berry picking, and gathering of basketry or ornamental plant materials. In some cases, the recreational activity has changed the condition of the resource/site important to tribes—for example, rock climbers putting pitons in a mountain or rock traditionally used by a tribe, or more visitors affecting dispersed camping sites or back country trails commonly used by a tribe.

Tribes are sometimes being out-competed by commercial operations for resources important to their rights and interests. There has been an increase in the commercialization of many plant species (for example, beargrass, mushrooms, huckleberries). Commercial pickers are increasingly competing with tribes for these resources, many which are associated with the exercise of a treaty reserved right.

Biophysical changes brought on by roads are also of concern to the tribes because changes to project area forests, rangelands, riparian areas, or streams affect American Indians' ability to obtain traditional plants, wildlife, fish, and cultural objects. For instance, as the Snake River sockeye and spring and fall chinook salmon runs have declined, so have the diets, economies, and culture of basin tribes. Wildlife species that have been negatively affected by roading and increasing human disturbance include grizzly bears, grey wolves, and other large carnivores.

Livestock Grazing

Grazing Before Euroamerican Settlement

Vegetation throughout the project area was in a continued state of change during the late Pleistocene (roughly 132,000 to 10,000 years ago; Grayson 1993) and the Holocene (the last 10,000 years; Grayson 1993, Miller et al. 1994). Changes in climate and frequency of fire were probably the primary disturbances influencing vegetation change before Euroamerican settlement. Grazing played a less dominant role (Aikens 1986, in Miller et al. 1994; Grayson 1993; Martin 1967, in Miller et al. 1994; Miller et al. 1994).

Large grazers were more abundant and diverse during the Pleistocene compared with the Holocene (Allison 1996, in Grayson 1993; Howe and Martin 1967, in Grayson 1993; Grayson 1993). Many of the large grazers, and various other mammals, became extinct in the late Pleistocene (Grayson 1993) but undoubtedly were encountered by the earliest human occupants of the Great Basin (Grayson 1993).

Large grazer abundance and diversity, at least in the Great Basin portion of the project area, were apparently much reduced during the Holocene compared with the late Pleistocene (Grayson 1993). Elk were present in the Great Basin portion of the project area at the end of the late Pleistocene and during the early Holocene (roughly 11,000 to 7,200 years ago; Grayson 1993). However, elk abundance declined substantially after this period. Grayson (1993) maintained that the Great Basin supported a far richer assemblage of large mammals toward the end of the Pleistocene than it does at current.

Grazing pressure thus probably declined in the Holocene. In the late Holocene, before Euroamerican settlement, environmental conditions along with hunting pressure by American Indians appeared to keep large grazer numbers low. Grazing impacts by large grazers were probably light, except in localized areas (Miller et al. 1994). Grazing was probably seasonal, with animals migrating between upper-elevation summer range and lower-elevation winter range (Burkhardt 1996, Miller et al. 1994). Consequently, the effects of grazing by large grazers was probably minimal and did not cause vegetation changes (Miller et al. 1994).

Livestock Grazing Since Euroamerican Settlement

Since the historical period, grazing pressure has increased substantially as Euroamericans introduced horses, sheep, and cattle. In the *alpine PVG*, excessive grazing pressure, primarily by sheep, has caused excessive erosion and removal of alpine vegetation (Hann, Jones, Karl, et al. 1997). In the early 1900s, Griffiths (1902, 1903) reported declines in native vegetation abundance and condition in the Great Basin portion of the project area and in eastern Oregon and Washington. He attributed this decline to the introduction of domestic livestock (particularly cattle and sheep) and wild horses to the region, and excessive livestock grazing pressure. The excessive livestock grazing pressure and its adverse effects on native vegetation were particularly apparent on Steens Mountain in southeast Oregon. Grassy areas, riparian areas (characterized by willow), and areas with aspen, were particularly overused by livestock. Griffiths estimated that in 1901, 182,500 sheep, or 175 sheep per square kilometer, were present on Steens Mountain.

Historical evidence indicates that most *riparian areas* in the project area have changed dramatically in the past 100 years, attributable greatly to excessive livestock grazing pressure ("improper livestock grazing" in Chaney et al. 1990). Improper livestock grazing was defined by Chaney et al. (1990) as concentrations of livestock at the wrong time (that is, season), in too great a number (that is, intensity), for too long (that is, duration), or any combination of these factors that results in riparian area degradation.

The change in riparian areas due to livestock grazing is related to livestock distribution and behavior. While riparian areas constitute only a small percentage (two to three percent) of the project area (Hann, Jones, Karl, et al. 1997, table 3.18), livestock (particularly cattle) activity has been disproportionately concentrated within riparian areas (Kovalchik and Elmore 1992, Marlow and Pogacnik 1986) compared with upland areas. Concentrated livestock activity in riparian areas has resulted in excessive grazing and physical damage by trampling.

Some ramifications of this include: (1) an increase in stream energy, (2) more bare soil and accelerated erosion, and (3) stream channel degradation, which has resulted in less water recharge of floodplains, lowered water tables, and reduced geographic extent of riparian plant communities. Erosion and stream channel degradation have caused an increase in suspended sediments and declines in water quality. Water temperatures have increased because of a decline in shade provided by vegetation. The structural diversity of vegetation has been simplified, early successional species have increased in abundance, and the result has been less productive plant and animal assemblages. The decline in abundance of some riparian species such as willow and cattails, which are associated with the rights and interests of tribes, has had a negative impact on tribes. Direct influences of livestock concentrations in riparian areas on water quality include bacterial and protozoal parasite contamination, and nutrient enrichment from fecal material in and near surface waters (Larsen 1996).

Livestock grazing has played a role in the *dry forest PVG* as well. Before Euroamerican settlement of the project area, and before extensive livestock grazing was introduced to the region, ponderosa pine forests

were typically savannah-like, appearing open and parklike, with stands of grass of varying densities and sparse tree recruitment (Coville 1898, Leiberg 1899, Leiberg et al. 1904, Pearson 1923, Rummell 1951, several historical accounts cited in Cooper 1960, Gruell et al. 1982). Livestock grazing, particularly excessive livestock grazing pressure (Weaver 1947b, Arnold 1950, Rummell 1951), has been implicated as one factor of many that have stimulated a shift from open parklike stands to stands with greater density of trees. On some areas within these forests, excessive livestock grazing pressure resulted in decreased herb abundance in the understory, which caused a decrease in fine fuel loads and a reduction in fire severity, which promoted tree seedling establishment.

In the late 1800s, livestock grazing played a major role, along with agriculture and the development of the railroad system, in the establishment and spread of *exotic undesirable plants*, many of which are now legally declared noxious weeds. Livestock grazing then and now acts to spread exotic undesirable plants, such as cheatgrass, medusahead, halogeton, and many others. Seeds of these species can be spread through livestock feces, fleeces, and hooves, and many pass through the digestive system and still retain their germination ability (Stoddart et al. 1953, in Mack 1986; Mack 1986). In addition to livestock, native grazers such as mule deer and elk, and birds such as mourning doves, perform this same role of seed spread of exotic undesirable plants.

Grazing pressure by large grazers on native vegetation in the project area has thus fluctuated over time. Large grazers were more abundant and diverse during the Pleistocene epoch compared with the Holocene epoch, and grazing pressure probably declined in the Holocene. Grazing pressure increased substantially as EuroAmericans settled the area and introduced sheep, cattle, and horses, perhaps even greater than during the Pleistocene. Adverse effects on native vegetation, particularly during the late 1800s and early 1900s, were evident in riparian areas, upland rangeland vegetative types, and the ponderosa pine and mixed-conifer forests of the dry forest PVG. These effects have resulted in many subsequent effects, such as increasing noxious weed invasion and spread, and negative effects on the plant species associated with the rights and interests of tribes. Grayson (1993) evaluated these changes from historical to current attributable to livestock grazing and concluded that, for the grasses, "The native grasses of the floristic Great Basin are not adapted to *heavy* [italics added] grazing by large mammals."

Interrelationships of Livestock Grazing and Vegetation Change (Succession) from Historical to Current

Platou and Tueller (1985) proposed that livestock grazing, and livestock grazing systems, that were patterned similarly to grazing as it happened pre-Euroamerican settlement, would be more compatible with vegetation in the Great Basin. However, pre-Euroamerican settlement conditions no longer exist in the project area. Agricultural and urban development, livestock grazing, the introduction of exotic plants, changes in climate (Tausch 1998), and changes in disturbance frequencies and severities, have resulted in unprecedented changes. Given these changes, two pertinent questions can be asked regarding livestock grazing.

Models of Vegetative Succession

Question 1: Can ecosystem functions and processes (such as vegetative succession) that have been altered by excessive livestock grazing pressure since the historical period be restored by removing livestock?

Answer: 1. Yes, in wetter systems such as riparian vegetative types. 2. Yes, in drier systems such as upland rangeland vegetative types, within areas that have not crossed a threshold to a stable, lower successional state. 3. No, in drier systems such as upland rangeland vegetative types, within areas that have crossed a threshold to a stable, lower successional state. See discussion below for more detail.

Current scientific thinking regarding livestock grazing pressure and its relation to vegetative succession typically falls into two general categories of models (Laycock 1994). The first and older model of vegetative succession is the traditional ***"climax" model*** (Figure 2-22), based on the work of Clements (1916) as modified for rangelands by Sampson (1919). The climax model is essentially a model upon which range condition is assessed, labeled typically as excellent, good, fair, or poor.

As used, the climax model has three assumptions:

1. A vegetative type has only one stable state, the climax, which is a stable plant community determined by climate.
2. Any change in the plant community away from climax (which is referred to as retrogression) that is caused by excessive livestock grazing pressure, results in an unstable state that can be reversed by reduction, manipulation, or elimination of livestock grazing. This reversal represents a movement of the plant community back towards the climax community, which is secondary succession. Thus, retrogression and secondary succession are opposite pathways of vegetation change; retrogression leads vegetation away from climax and thus into poorer condition, and secondary succession leads vegetation toward climax or excellent condition.
3. For a given plant community, its condition can change from poor to excellent or from excellent to poor. The change is continuous along a continuum (Vavra et al. 1994).

While livestock grazing management in the project area has been guided by principles of the climax model of vegetative succession during the 20th century, rangeland scientists have accumulated convincing evidence that not all rangeland vegetative types respond according to the climax model. Those that fit the climax model the best are the riparian PVGs, the cool shrub PVG, and the dry forest PVG. There are exceptions even within these PVGs where improvement might not be detected, particularly in cases of extreme past grazing abuse and/or noxious weed invasion.

The second, and more recent model is the *"state and transition" model* (Figure 2-23). This model is being proposed as more operative for most arid and semi-arid vegetative types in the interior West (Tausch et al. 1993, Laycock 1994, Tausch 1998). The reason is because many rangeland vegetative types, if they have retrogressed to lower successional states, can remain stable at these lower (more degraded) successional states for long periods of time, even if livestock grazing pressure has been reduced or eliminated. Under these conditions, active restoration in the form of rangeland modifications such as seedings and weed control are needed in addition to reduction or elimination of livestock grazing pressure to achieve secondary succession. Some examples of these vegetative types include ones in the dry shrub PVG, such as the big sagebrush, low sage, and salt desert shrub cover types.

The state and transition model defines vegetative states as recognizable, relatively stable assemblages of species occupying a site. Disturbances such as

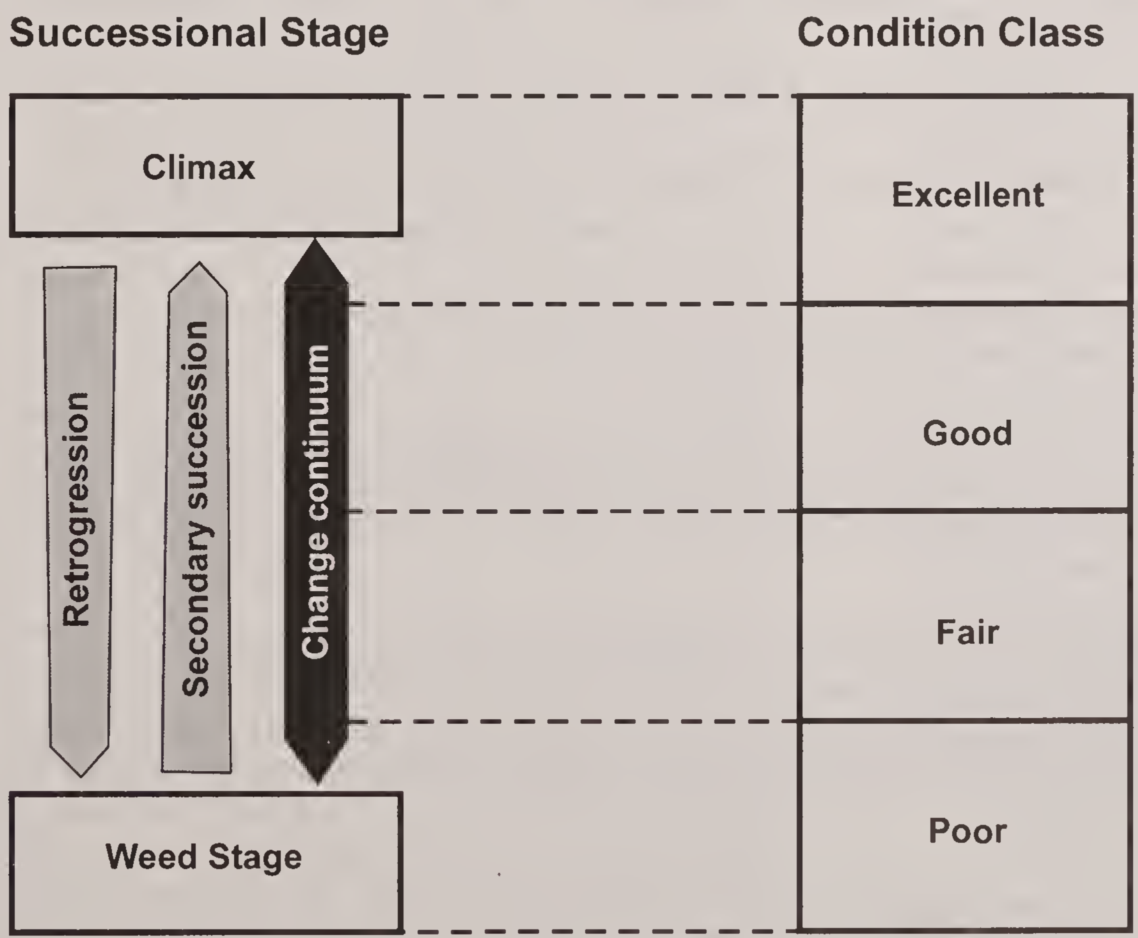


Figure 2-22. Climax Model For Vegetation Succession.
The climax model of vegetation succession and the approximate relationships between range condition and degree of retrogression from climax conditions. (Adapted from Ecological Implications of Livestock Herbivory in the West.

excessive livestock grazing pressure or altered fire frequency and severity, can cause vegetation to cross a threshold, or transition, to a stable state. These stable, lower successional states are typically not desired. Examples of apparently stable vegetative states in the project area are the cheatgrass–mustard and/or medusahead dominated areas within the dry shrub PVG, prevalent in the Lower Snake RAC, and western juniper dominated areas within the cool shrub PVG, observed in the Deschutes PAC, John Day RAC, and Lower Snake RAC.

In the cheatgrass–mustard and/or medusahead example, frequent fires result from the establishment of these highly flammable exotic annual grasses. Current fire-return frequencies as low as five years largely prevent establishment of perennial grasses and shrubs. Removal of livestock will not reduce fire frequencies and can exacerbate fire susceptibility through the subsequent accumulation of flammable litter.

The western juniper stable state is an example of the encroachment of woodland cover types and structural stages into the cool shrub and dry grass PVGs. Between historical and current periods, excessive livestock grazing pressure and fire suppression were two main factors that caused this encroachment. Excessive livestock grazing pressure, particularly in the late 1800s and early 1900s, contributed to a reduction in fuels that could carry fire, thereby decreasing fire frequency. Because woodland species, such as western juniper, can be killed from fire, a decrease in fire frequency favored their persistence and spread. In addition, excessive livestock grazing pressure, through consumption of herbaceous species, contributed to an increase in density and canopy cover of shrub species, primarily sagebrush. The establishment of shrubs provides conditions favorable to establishment of such woodland species as western juniper. Reduction or elimination of livestock grazing pressure will not necessarily convert dominance by woody plants to dominance by grasses and forbs, particularly on sites with these stable states where woody plant cover is dense and there is a sparse grass and forb understory. However, adjustments in livestock grazing pressure or rest from livestock grazing can result in improved soil stability (perhaps through biological crust development, for example), soil water levels, and nutrient levels, particularly on sites that have yet to cross the threshold to the stable vegetative state (Archer 1994; Hann, Jones, Karl, et al. 1997).

Estimates of the extent of rangeland vegetative types on BLM and Forest Service administered lands that have (1) crossed a threshold to a lower and more degraded stable successional state, (2) have not crossed a threshold but are at imminent risk of doing so, and (3) have not crossed a threshold and are not at imminent risk of doing so, are unknown. Knowing this information would help land managers determine the extent of rangelands that are in need of restoration, the intensity of restoration activities that would most likely achieve restoration, and the level of risk associated with achieving the restoration. With this infromation land managers could identify those rangelands that are in need of restoration that would most likely respond positively to changes in livestock grazing management alone, and identify those rangelands that are in need of restoration that would likely require costly, active resoration in addition to changes in livestock grazing management.

Livestock Management and Native Vegetation

Question 2: Can livestock be managed in a manner that would be compatible with native vegetation in the project area?

Answer: Yes, given certain conditions. See discussion below for more detail.

Archer and Smeins (1991) identified several examples of poor compatibility of livestock grazing management practices with native vegetation:

1. Traditionally, livestock are concentrated at artificially high levels. In contrast, densities of native grazers varied by season and by year.
2. Fences prevent livestock from moving to new areas when the abundance of desired forage declines. Consequently, traditional grazing practices result in higher frequencies and intensities of grazing than would have occurred with pre-Euroamerican settlement grazing.
3. Mortality of native grazers was a feedback loop that reduced grazing pressure, permitting recovery of native vegetation after periods of forage overuse. Supplemental feeding precludes mortality of livestock and maintains grazing pressure over a greater portion of the year and over a higher frequency of years, compared with grazing pressure exerted by native grazers.
4. As noted previously, prolonged grazing in grasslands or woodlands that are capable of supporting trees and shrubs has decreased the capacity of grasses to competitively exclude woody plants. It also concurrently reduced fire frequency, and usually, fire intensity, by preventing the accumulation of fine fuels. This has led to the western juniper stable state discussed previously.

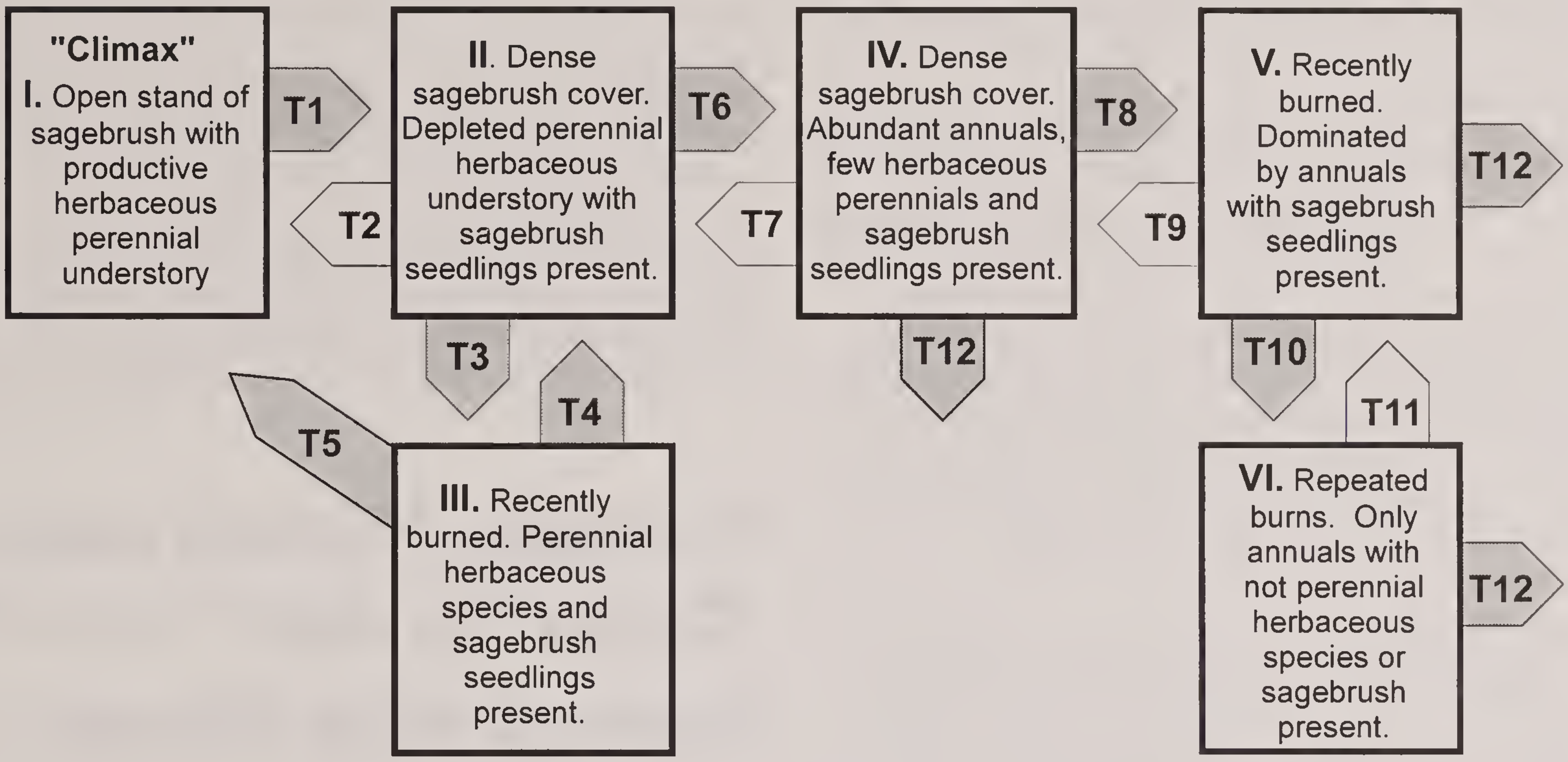


Figure 2-23. State and Transition Model for Sagebrush Grass Ecosystem.

States I, II, and III exist in areas without annual species (for example, cheatgrass or medusahead).

State I is the "climax" or condition undisturbed by livestock grazing. Transition arrow TI represents heavy grazing which causes deterioration of the understory and increased density and vigor of sagebrush.

State II is dominated by sagebrush and will remain stable for long periods of time. Transition T3 is fire or some other force (for example, insects, disease, or an herbivore that eats sagebrush) that reduces the sagebrush, which permits the understory to improve (State III).

With proper livestock grazing management (Transition T5), State III can move back to a state resembling State I. With heavy grazing (Transition T4), State III will move to State II, and sagebrush will again dominate the stand. State IV represents the situation in a heavily grazed area where a well-adapted annual-like cheatgrass exists. Continuous heavily grazing (Transition T6) of State II results in State IV, and perennials in the understory have been replaced by annuals.

The transitions of State IV to State V (Transition T8), and State V to State VI (Transition T10) represents the role of fires in the conversion to a stable cheatgrass-dominated plant community. Transition T12 represents intervention by humans, such as seeding of exotic perennial grasses (for example, crested wheatgrass). The Bureau of Land Management, for example, plants strips of vegetative fuel breaks consisting of crested wheatgrass, other grasses, forbs, and shrubs to slow the spread of fires. (Adapted from Ecological Implications of Livestock Herbivory in the West).

Grazing systems have been promoted to mitigate or prevent the detrimental effects on native plant communities. Under specific circumstances, rest-rotation, deferred, deferred rotational, and seasonal grazing systems have all been demonstrated to sustain upland rangeland plant communities within the sagebrush grassland and pine–bunchgrass zones in the project area (Vallentine 1990). However, none of these grazing systems have been conclusively more effective than light-to-moderate stocking levels under continuous seasonal use (Hart and Norton 1988, Heady 1975, Stoddart et al. 1975, Vallentine 1990). Thus, despite the array of grazing systems conceived and promoted during the past 40 years, there has been considerable debate over their compatibility with upland native plant communities. The debate is focused on which grazing system(s) are best prescribed to achieve compatibility with specific native plant community(ies), rather than on whether or not grazing systems as a whole are compatible.

In riparian areas, while total exclusion of livestock will improve riparian area conditions (Claire and Storch 1977, Duff 1977, Gunderson 1968, Winegar 1977), total exclusion is not always necessary to reduce negative impacts (Krueger and Anderson 1985). Land managers have been able to accomplish riparian area improvement concomitantly with livestock grazing (Chaney et al. 1990, Elmore 1992, Elmore and Kauffman 1994) through an increased emphasis on compliance with suitable grazing strategies and practices. There are limitations, however, associated with livestock grazing because, "In essence, livestock are NOT a 'tool' to improve riparian ecosystems. Rather, they are a cost that may often be accommodated and still enable successional advancement of riparian vegetation and attendant functional values [Krueger and Anderson 1985, Kindschy 1987]" (Kindschy 1994).

Grazing strategies, grazing practices, and grazing systems that are beneficial to achieving riparian area improvement can be found in more detail in Hann, Jones, Karl, et al. (1997). Numerous case study examples of riparian area improvement in the project area stem from incorporation of these grazing strategies, practices, and systems (Chaney et al. 1990, 1993; Kinch 1989). For many of the successful case studies, exclusion of livestock (two years or more) jump-started the recovery, thereby enhancing the effects of improved management implemented thereafter.

In summary, livestock grazing can be managed to sustain and even improve riparian vegetative types. Livestock grazing also can be managed to sustain upland rangeland vegetative types. However, particularly for the drier rangeland plant communities, when they have crossed a threshold and transitioned to a lower successional stable state, grazing systems, and no grazing, are unlikely to achieve a transition to a higher successional stable state (Archer and Smeins 1991). Sustainable grazing management, then, relies on knowledge of critical thresholds and manipulation of livestock (use of appropriate grazing systems, strategies, and practices) so these critical thresholds are not exceeded. Continued stocking at near-normal levels during periods of moderate to severe drought is probably the greatest cause of range deterioration (Vallentine 1990) and crossing of critical thresholds. Vallentine (1990) proposes that reduced livestock grazing intensities during moderate to severe drought, and for some time after drought, are necessary to minimize damage and hasten recovery of perennial vegetation.

Noxious Weeds and Other Exotic Undesirable Plants

The project area has experienced numerous exotic plant invasions in the past 100 years ([Franklin and Dyrness 1973, Yensen 1981, and Young and others 1972] in Mack 1986). As of the mid 1990s, approximately 862 species of exotic plants existed within the Pacific Northwest (Washington, Oregon, Idaho, Montana, and Wyoming; Rice 1994), nearly all of which inhabit the project area. These 862 exotic plant species represent 43 percent of the estimated 2,000 exotic plant species present in the entire United States (U.S. Congress, Office of Technology Assessment 1993, in Vitousek et al. 1996).

Many of the exotic plants existing within the project area originated in the Mediterranean region. The climate of the Mediterranean region (wet, cool autumns and winters; and dry, hot summers) is similar to the climate of the project area. Thus, many exotic plants are adapted to the project area climate (Trewartha 1981, in Mack 1986; Young et al. 1972, in Mack 1986).

Euroamerican settlement of the project area in the late 1800s facilitated the invasion and spread of exotic plants. Agriculture was the major avenue by which exotic plants initially entered the project area. The seed of many exotic plants was a contaminant of crop seed. The land-use change from wildlands to agriculture—a transition that was the most prevalent change between the historical and current periods in the project area—has promoted invasions of numerous exotic plants.

Of the 862 exotic plant species existing within the five-state region, 115 have been legally declared as "noxious weeds" by at least one of the five states.

Of the 862 exotic plant species existing within the five-state region, 115 have been legally declared as "noxious weeds" by at least one of the five states. "Noxious" is a legal classification and not an ecological term. Plants that can exert substantial negative environmental or economic impact can be designated as "noxious" by various governmental agencies. Noxious weeds are therefore a subset of the exotic plant species.

Success of Exotic Plants–Noxious Weeds

Present distributions of many exotic plants within the project area, including the noxious weeds, are increasing rapidly and in some cases exponentially (Asher 1994, Rice 1994, Rice and Rider 1995). This rapid rate of expansion has overwhelmed the ability to curtail the expansion. Uncoordinated weed control efforts throughout the project area have been ineffective against noxious weeds and other exotic plants.

This rapid rate of expansion is partly due to the life history of exotic plants. They are frequently among the first species to arrive and colonize areas where the soil surface has been disturbed or where plant cover is lacking. Their establishment and spread is aided by disturbance to the soil surface (Baker 1986, Bazzaz 1986). Exotic plants that have an opportunistic, colonizing life history—referred to as "colonizers" (Bazzaz 1986)—are typically prolific producers of seeds (or other reproductive parts such as rhizomes) and often are adapted to long-distance dispersal by means of vehicles, wind, wildlife, livestock, water, or machinery. They usually germinate under a wide variety of conditions, establish quickly, grow fast, and out-compete native species for water and nutrients. Some of the densest infestations of exotic plants are near roads, which provide a route for spread.

Other exotic plants, such as the noxious weeds spotted knapweed, yellow starthistle, and leafy spurge, can be labeled "invaders" (Bazzaz 1986). Invaders can establish within relatively intact vegetative cover, and displace native species without the aid of soil-surface disturbance. While noxious weeds can be colonizers or invaders or both, depending on the vegetative cover type, it is noteworthy and perhaps indicative of their noxious weed status that many of them act as invaders. For example, spotted knapweed, yellow starthistle, and leafy spurge have the ability to invade relatively undisturbed sites, including wilderness areas and national parks (Asher 1994, Tyser and Key 1988).

Why Exotic Plants–Noxious Weeds are a Problem

The rapid expansion of exotic plants–noxious weeds in the project area is one of the greatest threats to healthy native plant and animal communities. Noxious weeds are reducing the value of these native plant and animal communities in several ways, including: (1) decline in quality of aquatic-riparian and terrestrial habitats for wildlife; (2) reduction of forage for grazing animals; (3) potential increase in water runoff, sediment delivery, and soil erosion; (4) potential decline in water quality; (5) reduction in biological diversity; (6) negative impacts on or declines in native plant resources associated with the interests or reserved rights of American Indian tribes (see Appendix 8 for a partial list of these plants); and (7) increase in the economic burden of maintaining the quality of recreation and wilderness areas.

The invasion and spread of exotic plants can change the structure and composition of vegetative cover types and can change succession, preventing succession from leading to the vegetation that is the potential for a site. Indeed, the invasion and spread of exotic plants such as cheatgrass, medusahead, and many noxious weeds is apparent within many lower (less advanced) and relatively stable successional states in many rangeland vegetative cover types (see state and transition model of succession discussion in Livestock Grazing section previously). Native plant cover types can be changed to an exotic cover type. The reduction in biodiversity from the site scale to the watershed scale is becoming reality now. Billings (1994) warns that in the cheatgrass-dominated areas of the Intermountain region, including the Snake River Plains of the Lower Snake RAC, some native species are in danger of extirpation at the local or regional scale (see cheatgrass discussion below for more information on cheatgrass).

Accumulating evidence is revealing that invasions of exotic plants into native plant cover types can increase surface runoff and sediment yield (Lacey et al. 1989). This suggests that exotic plant species are not "holding the soil" as well as native species.

The susceptibility of vegetative cover types to invasion by noxious weeds and other exotic plants (see discussion on Susceptibility below for more detail) has led to declines in geographic extent of several vegetative cover types in the project area between the historical and current periods. Table 2-34 shows some selected cover types that have declined between the historical and current periods, partly because of invasion by the noxious weeds listed (see Appendix 5 for more detail). These cover types are important source habitats for the terrestrial vertebrates in the 12 Terrestrial Families.

Susceptibility of Broad-scale Vegetative Cover Types to Invasion

Dewey and et al. (1991) propose that "The precision and usefulness of federal weed control Environmental Assessment (EA) and Environmental Impact Statement (EIS) documents would be significantly improved by knowing the exact location and extent of lands vulnerable to specific noxious weeds." To this end, a measure of the susceptibility of the broad-scale vegetative cover types in the project area, to invasion by 25 weed species (24 noxious weeds, plus cheatgrass) is presented in Tables 2-35 and 2-36. For detailed discussion of each of the 25 weed species, including their county distribution within the project area and which cover types are susceptible to them, refer to Hann, Jones, Karl, et al. (1997).

Some major findings from Table 2-35 include the following. The first five findings are in agreement with Baker (1986) and Forcella and Harvey (1983).

- Grasslands, riparian areas, and some relatively open forests are more susceptible to invasion by exotic plants than are dense forests, high montane areas, and deserts. The former have frequent gaps in the plant cover, which favor exotic plant establishment, whereas the latter have relatively closed plant cover or have extreme climate, which is tolerated by only a few exotic plant species.

Table 2-34. Vegetative Cover Types in Decline Because of Noxious Weeds and Exotic Plants.

Cover Type[1]	Associated Potential Vegetation Group[2]	Noxious Weeds–Exotic Plants
Wheatgrass Bunchgrass	Dry Grass	Diffuse knapweed, spotted knapweed, yellow starthistle, rush skeletonweed, sulfur cinquefoil, medusahead, Dyers woad, dalmatian toadflax, yellow toadflax, common crupina
Fescue-Bunchgrass	Dry Grass	Spotted knapweed, leafy spurge, sulfur cinquefoil, oxeye daisy
Antelope Bitterbrush-Bluebunch Wheatgrass	Dry Shrub	Diffuse knapweed, cheatgrass[3], dalmatian toadflax, rush skeletonweed, sulfur cinquefoil
Big Sagebrush	Dry Shrub	Cheatgrass, medusahead, diffuse knapweed, rush skeletonweed, dalmatian toadflax, Dyers woad, Mediterranean sage, yellow starthistle
Herbaceous Wetlands	Riparian Herb	Kentucky bluegrass[2], Canada thistle, purple loosestrife, leafy spurge, saltcedar, musk thistle, Russian knapweed, spotted knapweed, Scotch thistle, yellow starthistle, hoary cress (whitetop), Mediterranean sage
Shrub Wetlands	Riparian Shrub	Canada thistle, leafy spurge, musk thistle, purple loosestrife, saltcedar, Russian knapweed, Mediterranean sage

[1] Selected vegetative cover types in the project area that have declined in area from historical to current periods, in part because of the noxious weeds listed for each type.
[2] The associated potential vegetation group in which the cover type resides.
[3] Not legally declared noxious in project area.

Source: Karl et al. (1995)

- The exotic forbs/annual grass cover type is the most susceptible to invasion by exotic plants. All 25 exotic plant species show some affinity for this cover type.
- Except for the exotic forbs/annual grass cover type, the grassland cover types (particularly fescue-bunchgrass, herbaceous wetlands, and wheatgrass bunchgrass) are the most susceptible to invasion by exotic plants. This finding is based on the large number of exotic plants labeled "invaders" in these grassland cover types.
- High-elevation cover types, particularly alpine tundra, whitebark pine/alpine larch, and whitebark pine, are the least susceptible to invasion by exotic plants. This finding is based on the small number of exotic plants labeled "colonizers" or "invaders" in these high-elevation cover types.
- Moist and shady forested cover types with little light in the understory (such as grand fir/white fir, mountain hemlock, Pacific silver fir/mountain hemlock) appear to be less susceptible to invasion by exotic plants than are drier, open-canopied forested cover types with greater light in the understory (such as interior ponderosa pine).
- Extremely arid cover types are less susceptible to invasion by exotic plants. For example, of all the rangeland cover types, salt desert shrub is the most arid and is also one of the least susceptible to exotic plant invasion.
- Some exotic plants show no affinity to many cover types in the project area. For example, some species such as purple loosestrife are found only in riparian areas.

Table 2-35 is a risk index that permits land managers and the concerned public to assess which cover types are most at risk of invasion by exotic plant species. Table 2-35 will require further revision as more information becomes available. For example, locality records for exotic plants including information on plant species that were found in the vicinity, would provide a link between the exotic species and a cover type and improve the ratings given in the risk index. Improvement in this risk index will enhance the ability of all to predict risk of invasion, assess where loss of biodiversity is at greatest risk, and assess where risk to changes to succession are greatest. Predicting noxious weed distributions in the future requires that we know which vegetative cover types are susceptible to invasion by the weed species, and where these cover types exist in relation to where the noxious weeds are distributed currently.

Integrated Weed Management

The least expensive, most effective, and highest priority weed management technique is prevention, especially prevention of new infestations of existing noxious weed species, and prevention of establishment of new exotic plants not currently residing in the project area. The magnitude and complexity of noxious weeds in the project area, combined with their cost of control, necessitates using Integrated Weed Management (IWM). Integrated Weed Management highlights the importance of prevention and involves the use of several control techniques in a well-planned, coordinated, and organized program to reduce the impact of weeds. The IWM strategy is discussed in more detail in Appendix 11.

Cheatgrass

Cheatgrass is an annual grass that was introduced to the project area from Europe in the late 1880s, probably via contaminated grain (Mack 1981, Mack and Pyke 1983). By 1930, cheatgrass had already attained its current distributional range in the western United States (Mack 1981) and has since been increasing in density. In 1995, cheatgrass existed in every county in the project area (Karl et al. 1995). A strong case could be made that cheatgrass is the most abundant exotic plant in the project area.

Cheatgrass has adapted to many cover types, from low-elevation salt desert shrub (Sparks et al. 1990, Young and Tipton 1990) to higher elevation ponderosa pine cover types (Daubenmire 1952). These cover types exist at elevations ranging from about 1,477 to 9,000 feet (450 to 2,745 meters), where the annual average precipitation ranges between 6 and 22 inches (15 and 56 centimeters; Bradley 1986).

Cheatgrass has several characteristics that aid its establishment in native plant cover types, particularly cover types that are under stress or have been disturbed. These characteristics include high seed production (Hulbert 1955), ability to germinate in the autumn or spring, greater ability to germinate than native grasses (Mack and Pyke 1983, Martens et al. 1994), tolerance to grazing, and population increase attributable to frequent fire (Klemmedson and Smith 1964).

Standing dead cheatgrass and litter produced by cheatgrass is extremely flammable and causes more frequent fire compared with fire frequency of the pre-

Euroamerican settlement period (Billings 1948). Native sagebrush cover types had fire-return intervals of 32 to 70 years (Wright et al. 1979), whereas cheatgrass-dominated areas that used to be sagebrush now burn as frequently as every 5 years or less (Pellant 1990). This situation is referred to by Pellant (1996) as the "cheatgrass–wildfire cycle". As a result of cheatgrass invasion and dominance and the more frequent fires, the extent of big game winter range in the Great Basin has declined (Pellant 1990, Updike et al. 1990), habitat supporting the densest concentration of nesting raptors in North America has declined (Kochert and Pellant 1986), the persistence of some native plant species is threatened (Rosentreter 1994), native plant species diversity has declined, non-game bird abundance has declined (Dobler 1994), and succession to the potential vegetation has been slowed or stopped (Billings 1994, Whisenant 1990). The cheatgrass–wildfire cycle presents the greatest risk to the Wyoming big sagebrush areas of the big sagebrush cover type, and to the wetter portions within the salt desert shrub cover type (Pellant 1990, Peters and Bunting 1994).

Cheatgrass typically provides adequate soil surface cover for watershed protection. However, in drought years and after wildfires, cheatgrass production can be inadequate to provide soil surface cover suitable for watershed protection. This is especially evident on sites with soils susceptible to water and wind erosion, and on sites with moderate to steep slopes. Under these circumstances, the potential for erosion is greater.

Ecological relationships between cheatgrass and biological crusts are not understood completely. Where intact, biological crusts apparently can restrict cheatgrass establishment (Kaltenecker and Wicklow-Howard 1994), but biological crust development appears to be restricted within cheatgrass-dominated plant communities, in comparison with native plant communities (Pellant and Kaltenecker 1996). After burning, cheatgrass can rapidly dominate sites and hinder the recovery of biological crust species. The lack of biological crust development and species richness might have negative implications in nutrient cycling, native plant succession, site stability, and exotic species invasion. Biological crusts are discussed in more detail in the Terrestrial Species section of this chapter.

Cheatgrass may be controlled by mechanical (disking or plowing), burning, grazing, herbicides, and biological control methods. These techniques vary in their effectiveness depending on factors including the growth stage of cheatgrass at the time of application, pre-and post-application climatic conditions, and soil water. Following control, revegetation with perennial plants is normally necessary.

Research conducted in southern Idaho (Hull 1974, Hull and Holmgren 1964, Hull and Stewart 1948) provides strong evidence that introduced wheatgrasses, especially crested wheatgrass, are superior to native grasses in establishing and persisting in communities previously infested with cheatgrass. However, controversy surrounds the use of exotic plants to revegetate rangeland communities infested with cheatgrass because of the resulting reduction in native plant species richness. Post-wildfire seeding with seed mixtures composed primarily of crested wheatgrass was a common practice to prevent cheatgrass dominance after wildfires and to provide livestock forage from the 1950s to the 1970s. This practice has continued to a certain extent into the current period (Pellant and Monsen 1993), and such seedings have reduced the extent of cheatgrass monocultures on the landscape. Although seeding of perennial grasses tends to perpetuate reduced levels of native plant species richness, it does more closely resemble the structure and disturbance regimes of native communities compared to cheatgrass monocultures. Therefore, recent trends toward the use of seed mixtures containing native species might ameliorate the reduction of native plant species richness (Pellant and Monsen 1993) and further approximate species compositions and disturbance regimes of native communities. Currently, the BLM normally uses native species in seeding mixtures where conditions are such that a native species mixture has a reasonable chance of establishment and persistence. Where native species mixtures are not expected to become established or persist in some of the more drier cheatgrass infestations, mixtures with crested wheatgrass are still used to control cheatgrass.

A proactive technique to reduce the cheatgrass–wildfire cycle is to seed strips of fire resistant vegetation (greenstripping) at strategic locations, in order to slow or stop the spread of wildfires (Pellant 1990). Herbaceous plant species commonly used in greenstripping include introduced wheatgrasses, Russian wildrye, dryland alfalfa, lewis flax, and small burnet (Pellant 1994). Greenstripping is not a solution to the cheatgrass–wildfire cycle, but it can help reduce the size and frequency of wildfires. The ecological benefits of greenstripping include conservation of native plant species richness and shrub cover on fire-prone landscapes, and the eventual enhancement of native plant species richness (West 1979, Whisenant 1990, Young and Evans 1978).

Cheatgrass distribution and dominance continue to expand, particularly in the dry forest, dry shrub, and dry grass PVGs. Although cheatgrass tends to form a

Table 2-35. Susceptibility of Broad-scale Cover Types to Invasion by Weed Species.[1]

Cover Type	Brte[2]	Canu	Caspp	Cedi	Cema	Cere	Ceso	Cevi	Chju	Chle	Ciar	Civu	Crvu	Eues	Hagl	Hiau	Hipr	Isti	Lida	Livu	Lysa	Onac	Pore	Saae	Taas
Alpine Tundra	L[3]	L	L	L	L	L	L	L	L	L	M	M	L	L	L	M	L	L	M	L	L	L	L	U	L
Aspen	M	M	M	M	M	M	M	M	M	M	H	M	M	M	M	M	M	M	M	M	L	U	M	U	M
Big Sagebrush	H	U	M	M	M	M	M	M	M	U	M	M	L	M	M	L	L	H	M	M	L	M	U	H	M
Bitterbrush/ Bluebunch Wheatgrass	H	M	M	H	M	U	M	M	U	U	M	M	M	M	M	L	L	M	M	M	L	U	M	U	M
Chokecherry/ Serviceberry/Rose	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	H	M	M	M	M	M	U	M
Cottonwood/Willow	M	M	M	M	H	M	M	M	M	H	H	M	L	H	L	M	H	M	M	M	M	M	M	U	M
Cropland/ Hay/Pasture	M	M	H	M	H	M	H	M	H	M	M	M	M	H	M	M	M	H	M	M	L	M	M	U	M
Engelmann Spruce/ Subalpine Fir	H	H	M	M	M	M	M	M	M	H	H	H	L	M	L	M	M	L	M	M	M	U	M	U	M
Exotic Forbs/ Annual Grass	H	M	H	M	M	M	H	H	H	M	M	M	M	M	M	M	M	H	H	H	M	M	H	M	M
Fescue-Bunchgrass	H	H	M	H	H	M	H	M	M	M	H	H	M	H	M	L	L	H	H	H	L	M	H	H	M
Grand Fir/White Fir	M	M	M	M	M	M	M	M	M	M	M	M	L	M	L	M	U	L	M	M	M	U	M	U	M
Herbaceous Wetlands	M	M	M	M	H	M	H	M	L	H	H	M	L	M	L	H	M	M	M	H	H	M	H	U	M
Interior Douglas-fir	H	H	M	M	H	M	M	M	M	M	H	H	M	M	M	M	M	M	M	M	L	M	H	U	M
Interior Ponderosa Pine	H	M	M	H	H	M	M	M	M	M	M	M	M	M	M	L	L	M	M	M	L	M	H	U	M
Juniper/Sagebrush	M	M	M	M	M	U	M	M	M	U	M	M	L	M	M	L	L	H	M	M	L	U	U	U	M
Juniper Woodlands	M	M	M	M	M	U	M	M	M	U	M	M	L	M	M	L	L	M	M	M	L	U	M	U	M
Limber Pine	M	M	M	M	M	M	M	M	M	M	M	M	M	L	M	M	L	M	M	M	L	L	M	U	M
Lodgepole Pine	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	L	M	M	M	L	M	M	U	M
Low Sagebrush	M	U	M	M	U	U	M	M	U	U	M	M	L	M	M	L	L	H	M	U	L	U	U	U	M
Mixed-Conifer Woodlands	H	M	M	M	H	M	M	M	M	U	H	M	L	M	M	L	L	M	M	M	L	U	H	U	M
Mountain Big Sagebrush	H	M	M	M	M	M	M	M	M	U	M	M	L	M	M	L	L	H	M	M	L	M	M	U	M
Mountain Hemlock	M	M	M	M	M	M	M	M	M	M	M	M	L	L	L	M	M	L	M	M	M	L	M	U	M
Mountain Mahogany	M	M	M	M	M	M	H	M	U	U	M	M	M	M	M	L	L	M	H	M	L	U	M	H	M
Native Forb	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	L	L	M	M	M	M	M	H	U	M
Oregon White Oak	M	U	M	M	M	M	M	M	M	M	M	M	M	M	M	L	L	M	U	M	L	M	M	U	M

Table 2-35. Susceptibility of Broad-scale Cover Types to Invasion by Weed Species.[1] (continued)

Cover Type	Brte[2]	Canu	Caspp	Cedi	Cema	Cere	Ceso	Cevi	Chju	Chle	Ciar	Civu	Crvu	Eues	Hagl	Hiau	Hipr	Isti	Lida	Livu	Lysa	Onac	Pore	Saae	Taas
Pacific Ponderosa Pine	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	L	L	M	M	M	L	M	M	U	M
Pacific Silver Fir/ Mountain Hemlock	M	M	M	M	M	M	M	M	M	M	M	M	L	L	L	M	M	L	M	M	M	L	M	U	M
Red Fir	M	M	M	M	M	M	M	M	M	M	M	M	L	L	L	M	M	L	M	M	M	L	M	U	M
Salt Desert Shrub	M	M	M	L	L	M	L	M	L	L	M	M	L	M	H	L	L	L	L	L	L	L	L	U	L
Shrub or Herb/ Tree Regen	M	M	M	M	M	M	M	M	H	M	M	M	M	M	M	M	L	M	M	M	L	M	H	U	M
Shrub Wetlands	M	H	M	M	H	M	M	M	L	M	H	H	L	M	L	M	M	M	M	M	H	M	M	U	M
Sierra Nevada Mixed-Conifer	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	L	L	M	M	M	L	M	M	U	M
Western Larch	M	M	M	M	M	M	M	M	M	M	H	M	M	M	M	M	M	M	M	M	L	M	M	U	M
Western Redcedar/ Western Hemlock	M	H	M	M	M	M	M	M	M	H	H	H	L	M	L	M	M	L	M	M	M	U	M	U	M
Western White Pine	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	L	U	M	U	M
Wheatgrass Bunchgrass	H	M	M	H	H	M	H	M	M	M	H	M	M	M	M	L	L	H	H	M	L	M	H	H	M
Whitebark Pine	L	L	L	L	L	L	L	M	L	L	M	M	L	L	L	M	L	L	M	L	L	L	L	U	M
Whitebark Pine/ Alpine Larch	L	L	L	L	L	L	L	L	L	L	M	M	L	L	L	M	L	L	M	L	L	L	L	U	L

[1] Broad-scale Cover Types in the basin and their susceptibility to invasion by 25 weed species (24 legally declared noxious, plus cheatgrass).

[2] Species codes for exotic plants: Brte = cheatgrass; Canu = musk thistle; Caspp = whitetop; Cedi = diffuse knapweed; Cema = spotted knapweed; Cere = Russian knapweed; Ceso = yellow starthistle; Cevi = squarrose knapweed; Chju = rush skeletonweed; Chle = oxeye daisy; Ciar = Canada thistle; Civu = bull thistle; Crvu = common crupina; Eues = leafy spurge; Hagl = halogeton; Hiau = orange hawkweed; Hipr = yellow hawkweed; Isti = Dyers woad; Lida = dalmatian toadflax; Livu = yellow toadflax; Lysa = purple loosestrife; Onac = Scotch thistle; Pore = sulfur cinquefoil; Saae = Mediterranean sage; Taas = medusahead.

[3] Ratings representing susceptibility to invasion, and definitions:

H = High susceptibility to invasion — Exotic plant species is an "invader" and invades the cover type successfully and becomes dominant or codominant even in the absence of intense or frequent disturbance;

M = Moderate susceptibility to invasion — Exotic plant species is a "colonizer" and invades the cover type successfully because high intensity or frequency of disturbance impacts the soil surface or removes the normal canopy cover;

L = Low susceptibility to invasion — Exotic plant species typically does not establish because the cover type does not provide suitable habitat; and

U = Unknown susceptibility to invasion — Herbarium mount labels did not report the species at the collection site that existed in association with the mounted exotic plants, or ecological requirements of the exotic plant are not available in the literature, or there was a lack of distribution records (for example, herbaria mounts) for the exotic plant, or the extent of the cover type in the Project Area might be so minor as to prevent or restrict the probability of obtaining distribution records for the exotic plant within that cover type.

Source: Hann, Jones, Karl, et al. (1997).

Table 2-36. Susceptible Cover Types Description[1].

Cover Type	Description
Alpine Tundra	*Phyllodoce* spp. (low shrubs)
Aspen	*Populus tremuloides*
Barren	Rock/Barrenlands
Big Sagebrush	*Artemisia tridentata wyomingensis* *Artemisia tridentata tridentata/Elymus cinereus* *Artemisia tripartita/Agropyron cristatum* *Artemisia tripartita/*Exotic Herbs *Artemisia tridentata tridentata/Agropyron* spp. *Artemisia tridentata tridentata/Bromus tectorum* *Artemisia* spp./*Bromus tectorum* *Artemisia tripartita*
Bitterbrush/Bluebunch Wheatgrass	*Purshia tridentata/Bromus tectorum* *Purshia tridentata/Agropyron spicatum*
Chokecherry/Serviceberry/Rose	*Prunus virginiana/Amelanchier alnifolia/Rosa* spp.
Cottonwood/Willow	*Populus trichocarpa/Salix* spp. *Populus* spp./*Cornus* spp. *Populus* spp./*Poa pratensis*
Cropland/Hay/Pasture	Dryland Crop Dryland Pasture/Hayland Irrigated Crop Irrigated Pasture/Hayland
Engelmann Spruce/Subalpine Fir	*Picea engelmannii/Abies lasiocarpa*
Exotic Forbs/Anual Grass	Exotic Forbs Exotic Grass (*Bromus tectorum/Taeniatherum caput-medusae/Poa secunda*) Exotic Herbaceous Exotic Herbs Exotic Perennial Grass
Fescue-Bunchgrass	*Festuca idahoensis/Agropyron* spp. Low Productivity Perennial Grass Perennial Native Bunchgrass Perennial Native Herbaceous Seeded Native Grass (*Agropyron spicatum/Festuca idahoensis*) Seeded Native Grass (*Poa secunda/Agropyron spicatum*) Small Perennial Grass
Grand Fir/White Fir	*Abies grandis/Abies concolor*
Herbaceous Wetlands	*Carex nebraskensis* *Carex rostrata/Carex aquatilis* Grass/*Carex* spp. *Elymus* spp.
Interior Douglas-fir	*Pseudotsuga menziesii* var. *glauca* *Pseudotsuga menziesii/Abies grandis*/Exotic Herbs *Pseudotsuga menziesii/Abies grandis/Populus* spp./Shrub
Interior Ponderosa Pine	*Pinus ponderosa* var. *scopulorum* *Pinus* spp./*Populus* spp./Exotic Herbs *Pinus* spp./*Populus* spp./Shrub
Juniper/Sagebrush	*Juniperus* spp./*Artemisia arbuscula/Festuca idahoensis*/Forb *Juniperus* spp./*Artemisia* spp./*Agropyron* spp.
Juniper Woodlands	*Juniperus* spp./Exotic Herbs *Juniperus* spp./*Artemisia arbuscula*/Shortgrass *Juniperus* spp. Forest/Exotic Herbs *Juniperus* spp. Woodlands *Juniperus* spp./Native Bunchgrass *Juniperus* spp./*Poa secunda*
Limber Pine	*Pinus flexilis*
Lodgepole Pine	*Pinus contorta*
Low Sagebrush	*Artemisia arbuscula*/Native Forbs *Artemisia arbuscula/Bromus tectorum* *Artemisia arbuscula*/Native Bunchgrass *Artemisia* spp./*Poa secunda*
Mixed-Conifer Woodlands	Conifer/Exotic Herbs Conifer Encroachment/Exotic Grass Conifer Encroachment/*Artemisia* spp./Perennial Grass Conifer/Perennial Grass
Mountain Big Sagebrush	*Artemisia tridentata vaseyana*/Perennial Grass

Table 2-36. Susceptible Cover Types Description[1]. (continued)

Cover Type	Description
	Artemisia tridentata vaseyana/Exotic Herbs *Artemisia tridentata vaseyana*/Perennial Herbs
Mountain Hemlock	*Tsuga mertensiana*
Mountain Mahogany	*Cercocarpus* spp.
Native Forb	*Deschampsia* spp./*Calamagrostis* spp. Exotic Moist Herbs Exotic Riparian Herbs Native Forbs Pioneer Forbs
Oregon White Oak	*Quercus alba*/Exotic Herbs *Quercus alba*/Shrub
Pacific Ponderosa Pine	*Pinus ponderosa* var. *ponderosa*
Pacific Silver Fir/Mountain Hemlock	*Abies amabilis*/*Tsuga mertensiana*
Red Fir	*Abies magnifica* var. *shastensis*
Salt Desert Shrub	*Sarcobatusvermiculatus* *Sarcobatus vermiculatus*/*Distichlis stricta* Salt Desert Shrub[2]
Shrub or Herb/Tree Regen	General Shrub Grass/Forb Mid Shrub West Cascades Mountain Shrub - No other Mountain Shrub/*Ceanothus* spp. Shrub/Regen
Shrub Wetlands	*Cornus* spp./*Crataegus* spp. Gravel Bar *Salix* spp. low/*Carex* spp. *Salix* spp. low/Grass *Salix* spp./*Calamagrostis* spp. *Salix* spp./*Carex* spp./*Castor canadensis* *Salix* spp./*Poa pratensis* *Sarcobatus vermiculatus*
Sierra Nevada Mixed-Conifer	Sierra Nevada Mixed-Conifer
Urban	Urban Land
Water	Water
Western Larch	*Larix occidentalis*
Western Redcedar/Western Hemlock	*Thuja plicata* /*Tsuga heterophylla*
Western White Pine	*Pinus monticola*
Wheatgrass Bunchgrass	*Agropyron cristatum* *Agropyron cristatum*/*Bromus tectorum* *Agropyron spicatum* *Agropyron* spp./*Poa secunda* *Aristida longiseta* *Bromus tectorum* *Elymus cinereus* *Elymus cinereus*/*Agropyron* *Elymus cinereus*/*Bromus tectorum* Exotic Annual Grass Fire Maintained Grass (*Poa secunda*/*Agropyron spicatum*) Native Perennial Grass Perennial Herbs *Poa secunda*/*Festuca octoflora* *Poa pratensis* *Poa secunda* *Poa secunda*/Perennial Forbs Seeded Exotic *Agropyron* spp. *Sitanion hystrix*
Whitebark Pine/Alpine Larch	*Pinus albicaulis*/*Larix lyallii* *Pinus albicaulis*/ *Larix lyallii*/*Abies lasiocarpa*
Whitebark Pine	*Pinus albicaulis*

[1] Description of broad-scale cover types in the Basin used in Table 2-35 to characterize the susceptibility of vegetation types to invasion by weed species.
[2] Four representative plants in the Salt Desert Shrub type found within the Basin are *Eurotia lanata* (winterfat), *Atriplex confertifolia* (shadscale), *Elymus cinereus* (Great Basin wildrye), and *Grayia spinosa* (spiny hopsage).

Source: Hann, Jones, Karl, et al. (1997).

stable vegetation state after establishment, because of frequent fire, other exotic plants are invading cheatgrass-dominated communities and potentially degrading rangeland health even further. Examples of these other exotic plants include medusahead, yellow starthistle, and ventenata.

Composite Landscape Conditions

The condition of the interior Columbia Basin has changed in the last century. Changes in vegetation composition and structure, brought about by changes in succession/disturbance regimes, have led to dwindling populations of some aquatic and terrestrial species, substantial increases in others, and reduced capacity to achieve social and economic values. The project area is experiencing effects from disturbances that are not characteristic of the past when basin ecosystems were more balanced. These effects can be measured in a variety of different ecosystem variables and characteristics. Together, the effects can be interpreted to show a decline in overall landscape health.

One of the measures of landscape conditions is the departure of Historical Range of Variability (HRV departure). HRV departure is a comparison of how current patches in a subwatershed landscape differ from the normal range and variability of historical landscape patches in their vegetation composition and structure and succession/disturbance regime.

A set of broad-scale representative variables were used to assess the "composite HRV departure" of vegetation patches. These variables include vegetation composition, structure, size, contagion (proximity to other patches of vegetation), succession and disturbance processes, in the context of whether the biophysical setting is appropriate, based on the findings of Hessburg et al. (1999) and Hann et al. (1997). The intent was to integrate vegetation patch size, shape, composition, structure, environment, fragmentation, contagion, and succession/disturbance regime into one index for each subwatershed (Hemstrom et al. 1999). These individual subwatershed indexes were then added to achieve an estimate of the broad-scale composite HRV departure.

In general, BLM- and Forest Service-administered lands are less departed from historical conditions than other lands due mainly to agriculture and other development on much of the lands not administered by the BLM or Forest Service. Over half the BLM- and Forest Service-administered lands in the project area are currently in a high or moderate HRV departure class (see Figure 2-24), which means they are moderately or highly different than historical conditions. Large areas of high departure on BLM- and Forest Service-administered lands can be found in the Butte RAC, Eastern Washington RAC, Upper Columbia-Salmon Clearwater R1 RAC, and the Klamath PAC (see Map 2-35).

The ecological integrity trend variable (Quigley et al. 1999) used in the Supplemental Draft EIS is generally equivalent to the ecological integrity variable (Quigley et al. 1996 and 1997) as defined in the Scientific Assessment and Draft EISs. It is based on the average trends of subwatershed composite HRV departure, aquatic habitat conditions, and road density. Using this measure, half of the BLM- and Forest Service-administered lands in the project area are currently classified as having low ecological integrity (see Figure 2-25). The highest concentration of subwatersheds in the high ecological integrity category can be found in the Eastern Washington-Cascades PAC and Upper Columbia-Salmon Clearwater-R4 RAC (see Map 2-36).

Landscape health is defined by Hann et al. (1999) as "the best fit of the dynamic interaction of human land use, biodiversity, and ecosystem health that is in balance with the limitations of the biophysical system and inherent disturbance processes." In this analysis all the subwatersheds in the project area currently fall into the moderate, low, and very low landscape health categories; none are high or very high (see Figure 2-26). The highest concentration of subwatersheds in the moderate category of landscape health can be found in the Eastern Washington-Cascades PAC and Upper Columbia-Salmon Clearwater-R4 RAC (Map 2-37).

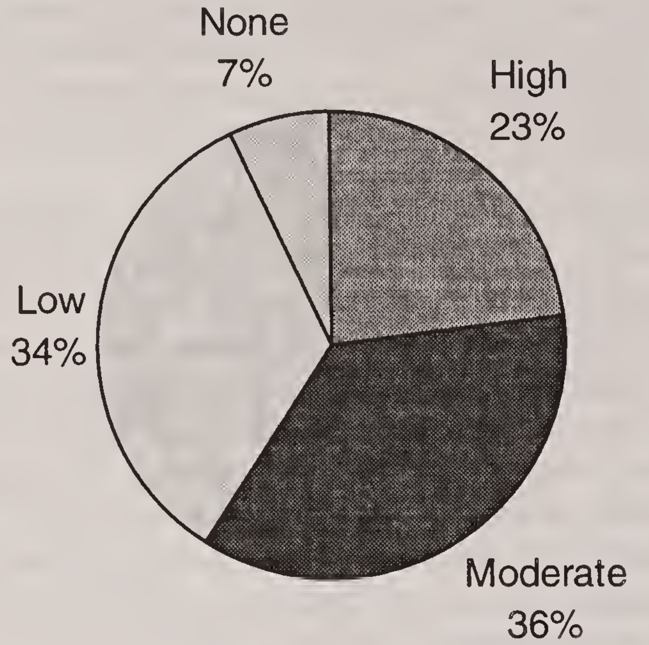


Figure 2-24. Current HRV Departure Class, Forest Service- and BLM-administered Lands.

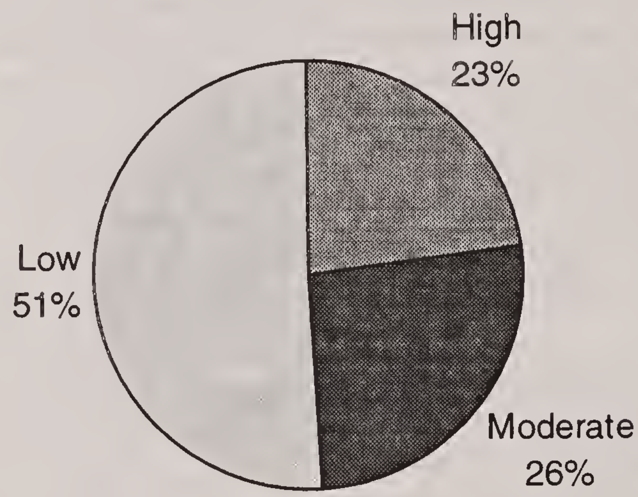


Figure 2-25. Current Ecological Integrity, Forest Service- and BLM-administered Lands.

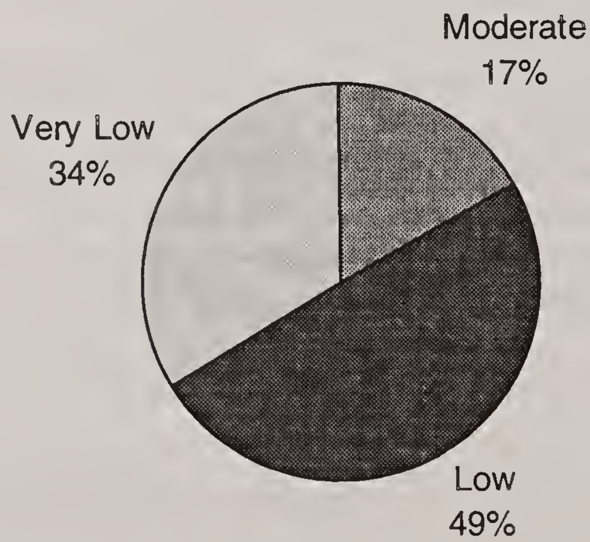
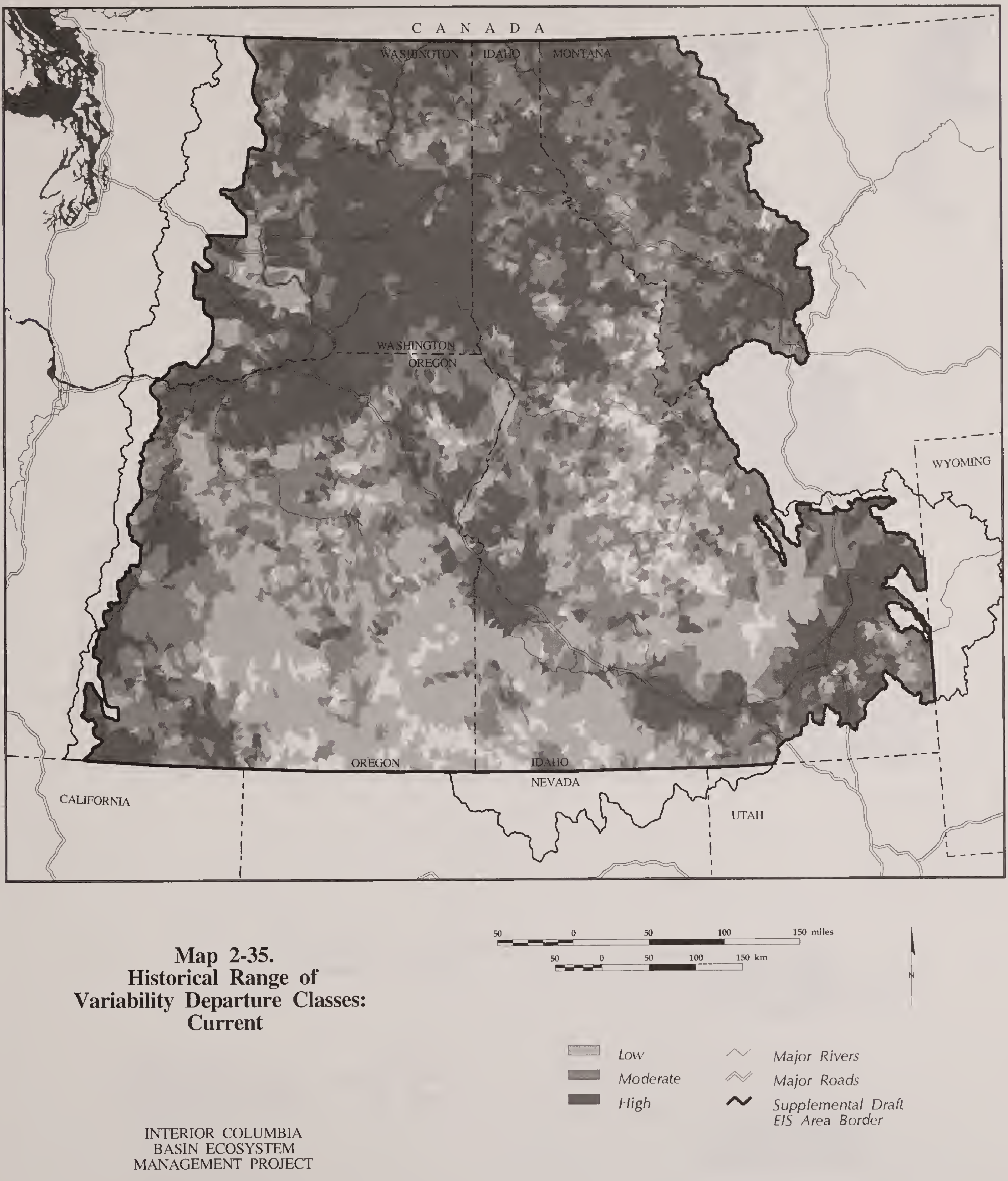


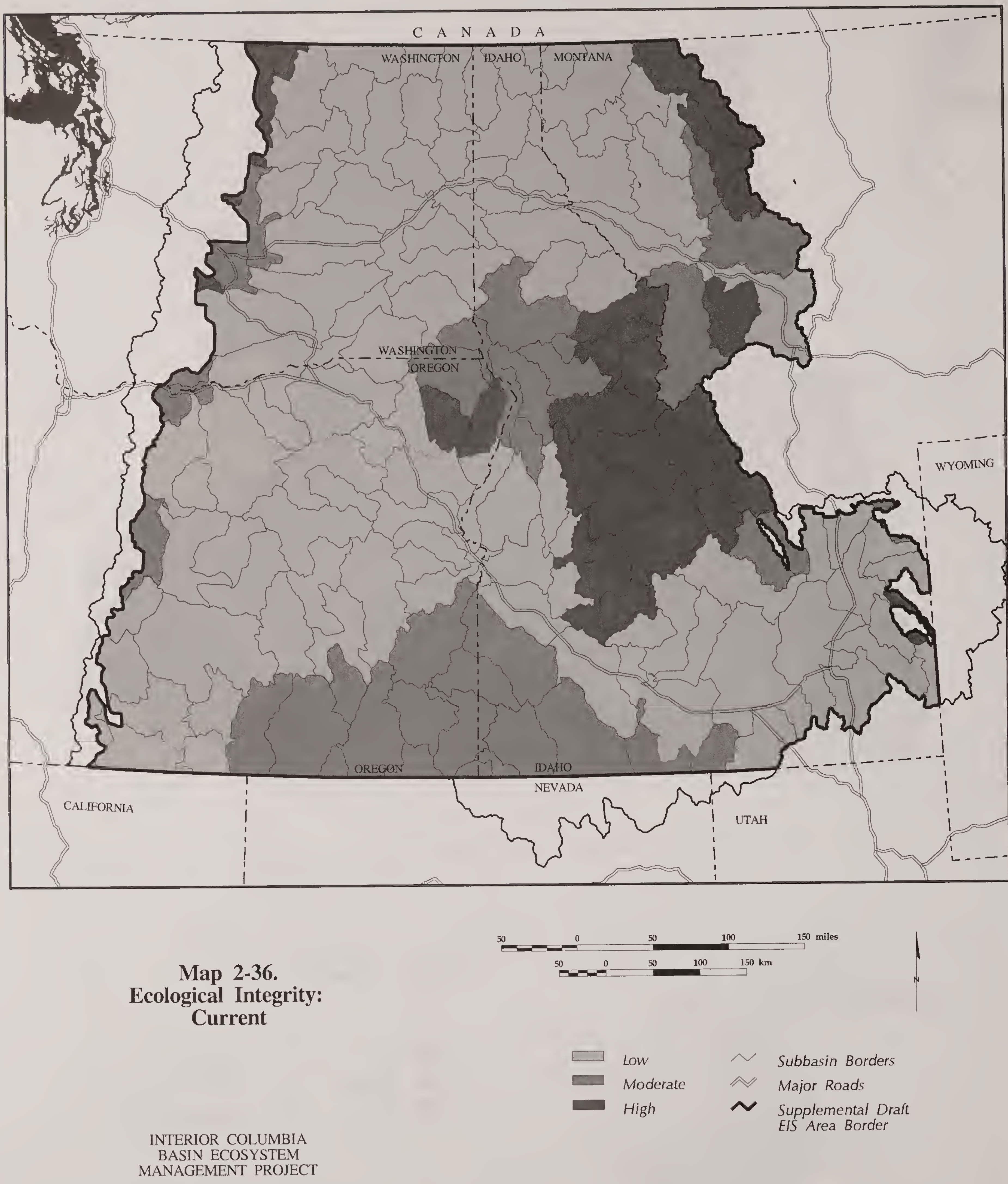
Figure 2-26. Current Landscape Health Conditions, Forest Service- and BLM-administered Lands.



Map 2-35.
Historical Range of Variability Departure Classes: Current

INTERIOR COLUMBIA BASIN ECOSYSTEM MANAGEMENT PROJECT

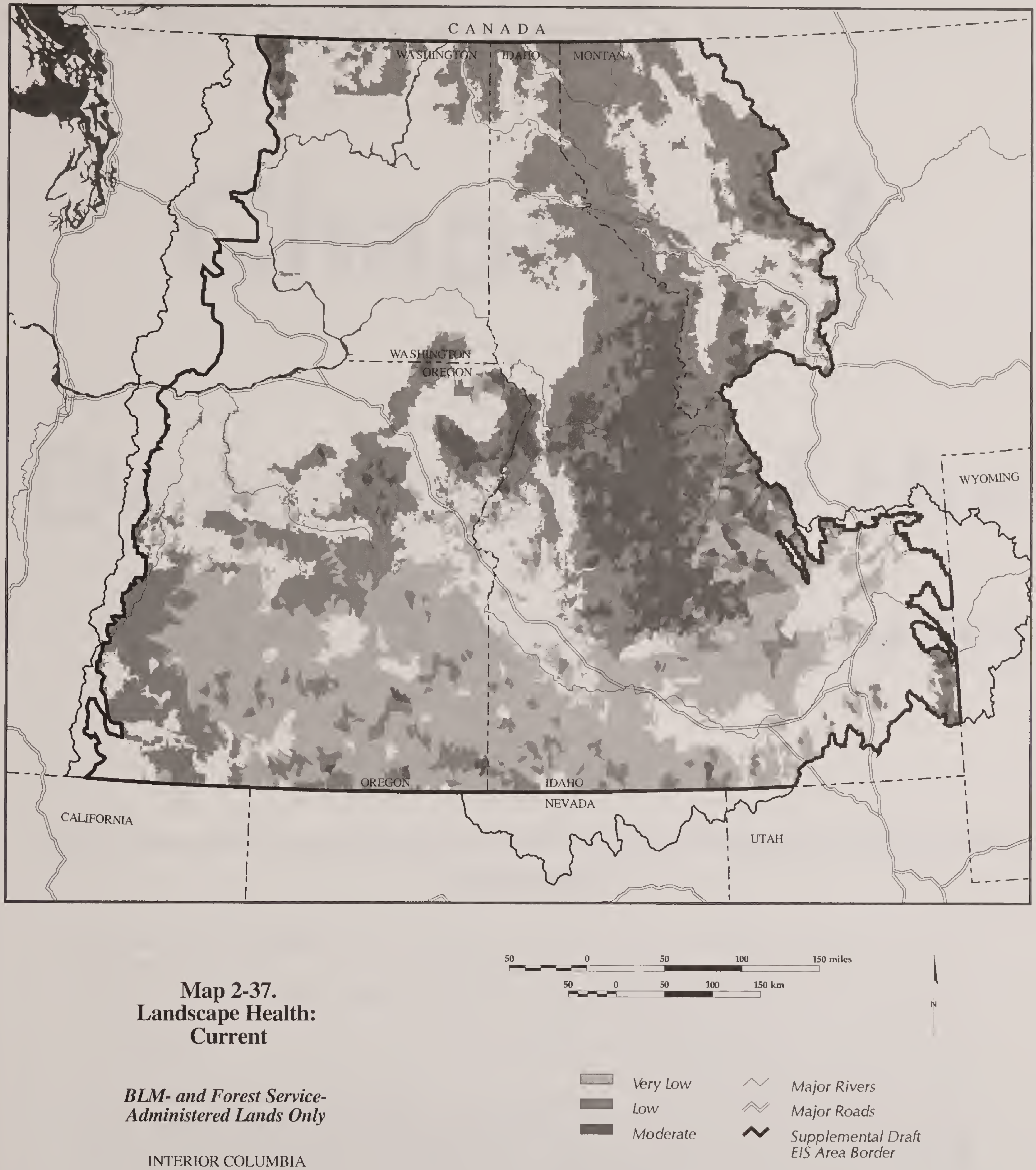
Supplemental Draft EIS Area
2000



Map 2-36.
Ecological Integrity:
Current

INTERIOR COLUMBIA
BASIN ECOSYSTEM
MANAGEMENT PROJECT

Supplemental Draft EIS Area
2000



Map 2-37. Landscape Health: Current

BLM- and Forest Service-Administered Lands Only

INTERIOR COLUMBIA BASIN ECOSYSTEM MANAGEMENT PROJECT

Supplemental Draft EIS Area
2000

Chapter 3

Description of the Alternatives

Contents

Key Terms Used in Chapter 3

Fine-scale — A small landscape, such as a watershed (50,000 to 60,000 acres), a subwatershed (approximately 20,000 acres), or in some cases, groups of watersheds or subwatersheds.

Goal — The state or condition that implementation of this Record of Decision (ROD) is intended to achieve. Goals in the ICBEMP EIS and ROD are expressed in broad, general terms, and are timeless in that they are not required to be completed by a certain date. Goals form the principal basis from which objectives are developed, and are consistent with the purpose and need statement.

High Restoration Priority Subbasins — Subbasins identified by the ICBEMP as high priority for restoration at the broad scale, where management intent is to concentrate restoration efforts (such as aquatic, water quality, vegetation management, or reestablishing fire) and to make restoration activities more effective and efficient.

Long Term — As used in this chapter, more than 10 years.

Mid-scale — A subregional area, such as groups of subbasins or a RAC/PAC (Resource Advisory Council/ Provincial Advisory Committee) area.

Objective — Indicates short-term (10 years) and/or long-term outcome(s) that is(are) expected or desired. Objectives are more specific than goals, and they focus primarily on conditions or processes we are trying to achieve or prevent rather than on specific actions or restrictions. Whenever possible, time periods expected to attain the outcome are specified.

Actions taken after the ICBEMP ROD is signed must be consistent with the objectives. In the long term (more than 10 years), management actions must move broad-scale resource conditions toward the desired conditions described in the objectives. If actions are moving toward a different condition than is described by the goals or objectives, then the agencies are not in compliance with the ROD. However, ICBEMP objectives are broad scale; therefore, it is neither expected nor appropriate to achieve each objective to the same degree on every acre of Forest Service- or BLM-administered land in the project area. Nor is it intended that each activity authorized will individually meet or forward each objective.

Short Term — 10 years or fewer.

Standard — Required action, priority, process, or prescription that addresses how to achieve one or more objective(s). Standards can include restrictions on or prohibitions from taking an action in certain areas or situations. Compliance with standards, as with objectives, is mandatory. If standards are not followed, then the agencies are not in compliance. When "shall" is used in a standard, the action is mandatory. When "should" is used in a standard, the action is mandatory unless other actions (including non-action) meet the intent of the standard.

Guideline — Suggested action, priority, process, or prescription that would be useful in meeting one or more objective(s). Guidelines are not required but are included in the ICBEMP EIS and ROD to further explain the EIS Team's intent in how to meet the objectives. "May", "can", or "could" are used in guidelines to indicate that they are suggested techniques, which are optional.

Introduction

Background

This is a brief summary of the background information presented in Chapter 1. On June 6, 1997, two draft environmental impact statements (EISs) for the Interior Columbia Basin Ecosystem Management Project (ICBEMP) were released to the public. An 11-month comment period with extensive outreach followed release of the draft EISs.

Based on public, agency, and science input on the draft EISs, new information from science, and discussions with tribal and interagency partners, a refinement to the design of the overall strategy for the project was initiated. This refined focus was emphasized in a letter from the Secretaries of Agriculture and the Interior (October 8, 1998) to those members of the Congress who represent constituents of the states located in the project area. The new approach would address a limited number of issues which must be resolved at the basin level, while allowing flexibility for other issues to be dealt with at finer scale or local levels. This new approach was to be presented in a supplemental draft EIS. The new approach in management direction, presented here in Chapter 3 of the Supplemental Draft EIS, focuses on four basic components: (1) landscape succession/disturbance, (2) terrestrial species habitat, (3) aquatic habitat, and (4) human needs, products, and services.

The revised strategies also include a more detailed description of how local Forest Service and BLM managers and their staffs can take the broad-scale information and management direction portrayed in this EIS, and "step it down" to mid- and fine scales. The step-down processes allow local managers to consider site-specific conditions when designing activities to meet broad-scale expected outcomes. (In this EIS, mid scale is a subregional area, such as groups of subbasins or a RAC/PAC [Resource Advisory Council/Provincial Advisory Committee] area. Fine scale is a smaller landscape, such as a watershed [50,000 to 60,000 acres], a subwatershed [approximately 20,000 acres], or in some cases, groups of watersheds or subwatersheds). The step-down processes include Subbasin Review and Ecosystem Analysis at the Watershed Scale (EAWS).

Finally, the revised strategies provide the ability to accommodate a range of funding levels. Therefore, if additional funding should be available to the agencies, the broad-scale priorities, opportunities, and management emphases have already been identified.

Alternatives Considered but Eliminated Prior to Release of the Draft EISs

During the extensive public involvement process that started with scoping and the publication of the Notice of Intent to prepare the Eastside and Upper Columbia River Basin Draft EISs, several public groups, tribes, and government agencies participated by offering written suggestions for formulation of alternatives or parts of alternatives. Those offering suggestions for the Draft EISs included several American Indian tribes, Eastside Ecosystem Coalition of Counties, Weyerhauser Corporation, Boise Cascade Corporation, World Wildlife Fund, and federal regulatory agencies, including the National Marine Fisheries Service, the U.S. Fish and Wildlife Service, and the Environmental Protection Agency.

Only one fairly complete alternative was presented for the EIS Team to consider. This came from the Forest Service Employees for Environmental Ethics (FSEEE). The EIS Team determined that, taken in its entirety, the FSEEE alternative did not fully address the purpose of and need for action. Specifically, it did not meet the need to support the economic and/or social needs of people, cultures, and communities, and to support predictable and sustainable levels of goods and services from Forest Service- and BLM-administered lands. Further, the proposed alternative was not based on the *Scientific Assessment*. Although the FSEEE alternative was not described in its entirety as a separate alternative, nor was it analyzed in detail, several of its elements were incorporated into Alternative 7 in the Draft EISs.

Suggested Combinations of the Draft EIS Alternatives

During the 11-month public comment period for the Draft EISs, many people submitted comments suggesting that the EIS Team combine parts of the seven alternatives to better address issues. These suggestions were reviewed by the EIS Team in light of the purpose and need statement, issues identified through the public scoping process, the narrowed focus and broad scale look at which this Supplemental Draft EIS was written, information available from the Science Team, and the themes of the alternatives already presented in the Draft EISs. To the extent the suggestions helped meet the purpose and need and address identified issues at the broad scale of this Supplemental Draft EIS, they were used in development of the two new "action" alternatives. The following are examples of a few of these suggestions (see Appendix 4 for the summarized public comments and the EIS Team's response on how those comments were used):

- Combine Alternatives 4 and 7 to provide better protection for areas designated "low ecological integrity" by calling for active restoration and areas of "existing high integrity" by including them in a system of reserves.
- Combine Alternatives 4 and 6 to restore damaged areas and take a slower management approach, emphasizing conservation, research, and extensive monitoring.
- Combine Alternatives 6 and 7 to use the active management activities along with a system of reserves.
- Combine Alternatives 2 and 5 to provide for improved forest and rangeland health, restoration of riparian health, and more timber harvesting and fewer roadless areas.
- Combine Alternatives 3, 4, and 5, to provide substantial levels of forest restoration and resource protection.

Many commented that they favored the Draft EIS preferred alternative (Alternative 4) with additional elements found in Alternatives 5, 6, and 7. They felt this combination was an active restoration approach to management. Some suggested that Alternative 4 should focus on aggressive ecosystem restoration and support of the local communities. Others endorsed the ideas submitted by the Natural Resource Defense Council for protection of the environment through halting commercial harvesting in old-growth forests and roadless areas. Ideas proposed by the Columbia River Bioregional Campaign promoted the active-yet-cautious approach to closely monitor restoration and emphasize non-motorized recreation. Some comments suggested the EIS Team consider the Oregon State Plan, which calls for protection of remaining old-growth stands and protection of riparian and roadless areas. Others suggested an alternative that would allocate specific areas for emphasis of management priorities, such as locations where commodity extraction or grazing would be emphasized.

The Supplemental Draft EIS describes and analyzes three additional alternatives (Alternatives S1, S2, S3) in response to these many suggestions. While the FSEEE alternative and other proposals were not brought forward wholly and in detail, many of the concepts offered by various organizations and other governmental agencies have been incorporated into Alternatives S2 and S3. (Alternative S1, no-action, would continue with present management; it is based on Alternative 2 of the Draft EISs, recognizing that the interim management for protection of eastside forests, and anadromous and other native fish habitat has become part of Forest Service and BLM land use plans across the project and accurately represents the "no change" alternative.)

For example, Alternatives S2 and S3 identify and map specific important habitats with intact succession/disturbance patterns that are strongholds for aquatic species (A1 and A2 subwatersheds) or important as source habitats for families of terrestrial species (T watersheds). These two alternatives also identify areas with broad-scale priority for restoration. Both Alternatives S2 and S3 provide broad-scale restoration direction that links ecological needs and opportunities to social and economic (including tribal) needs and opportunities. These features are compatible and consistent with many of Governor Kitzhaber's 11 points, the FSEEE alternative, the Deschutes Provincial Advisory Committee proposal, tribal government proposals, the Eastside Ecosystem Coalition of Counties, and many other suggestions. This is because Alternatives S2 and S3 strive to improve ecosystem health through the maintenance and restoration of riparian, forest, and rangeland vegetation structure and composition; and through protection of old forests and important fish and wildlife habitats, while at the same time providing for social and economic needs of people, cultures, and communities.

Monitoring and adaptive management, which many commentors stressed are necessary, are key features of both Alternatives S2 and S3. Implementation of the ICBEMP decision will use an adaptive management approach—a continual process to modify plans and activities over time, as necessary. An implementation and adaptive management framework is provided in Appendix 10.

How the Chapter is Organized

The introduction to this chapter describes alternatives that were considered but eliminated and Draft EIS alternative combinations suggested by the public. A Summary of Alternatives Considered in Detail is presented next, to help the reader understand the general concepts of the three alternatives that were considered in detail in the Supplemental Draft EIS. The selection of the preferred alternative is discussed following the summary. The details of the management direction for Alternatives S1, S2, and S3 are then presented in the remainder of the chapter.

Alternative S1 (the No-Action Alternative) is presented first. It has been structured to be as parallel as possible to the description of Alternatives S2 and S3 (organized by the four major components).

The key similarities and the key differences between Alternatives S2 (the preferred alternative) and S3 are highlighted, followed by the description of management direction and management intent for both alternatives. The action alternatives begin with the step-down process, adaptive management, and monitoring; then the four main ecosystem components (landscape dynamics, terrestrial habitat, aquatic/riparian/hydrologic habitat and processes, and social-economic-tribal considerations) are described under base level direction and restoration direction. Management direction and intent for certain special aquatic (A1 and A2 subwatersheds) and terrestrial (T watersheds) delineations complete the chapter.

Summary of Alternatives Considered in Detail

Introduction

Seven alternatives were developed and analyzed in the Eastside and UCRB Draft EISs (May 1997). Those alternatives have not been pulled forward to this Supplemental Draft EIS, but any or all of them are still available for the ICBEMP Executive Steering Committee to select. If any of the original alternatives from the Draft EISs are brought forward, then a clear, sharp comparison between the Draft EIS alternatives and Supplemental Draft EIS alternatives will be made and disclosed to the public.

The seven alternatives presented in the Draft EISs, plus public comment received on those alternatives, plus new science information developed since the Draft EISs were published were used to develop three additional alternatives for detailed consideration in this ICBEMP Supplemental Draft EIS: Alternatives S1 (no-action), S2, and S3. Overall goals of a management strategy for Forest Service- and BLM-administered lands in the project area guide the alternatives. A theme and management direction are presented for each alternative. The management direction for Alternatives S2 and S3 includes a description and management intent, objectives, standards, and guidelines. See Key Terms box for definitions.

A description and management intent section is provided for many of the strategies or resources. It is intended to clarify the context for objectives and standards and to be followed as a component of the direction. In some cases an objective, standard, or guideline may be accompanied by a rationale, which includes background, examples, or further explanation of what was intended by the direction.

The action alternatives considered in detail, Alternatives S2 and S3, reflect the refined focus and approach as described above. They also respond to the Purpose and Need statement in Chapter 1, which is the same as it was in the draft EISs. The presentation of direction for both the no-action and action alternatives begins with direction related to "step-down" (implementation and analysis considerations), adaptive management, and monitoring. Remaining direction is organized to focus on the four basic components:

- Landscape dynamics,
- Terrestrial source habitats and species,
- Aquatic/riparian/hydrologic habitat and processes, and
- Social-economic-tribal considerations.

Alternative S1

Theme

Alternative S1 (no action) continues management specified under each existing Forest Service and BLM land use plan, as amended or modified by interim

direction—known as Eastside Screens (national forests in eastern Oregon and Washington only), PACFISH, and INFISH—as the long-term strategy for lands managed by the Forest Service or BLM. The final standards for rangeland health and guidelines for livestock grazing management (Healthy Rangelands) currently being implemented on BLM-administered lands in Idaho, Montana, Oregon, and Washington are continued on the same lands. The reasonable and prudent measures, terms and conditions, and/or conservation recommendations from the Biological Opinions on the Forest Service Land and Resource Management Plans as amended by PACFISH and INFISH are maintained and followed where applicable.

Forest Service- and BLM-administered lands would continue to be managed by direction in each individual existing land use plan (currently 64 plans), recovery plan, and other current direction.

Forest Service- and BLM-administered lands would continue to be managed by direction in each individual existing land use plan (currently 64 plans), recovery plan, and other current direction. These land use plans cover diverse ecosystems and have distinct, and sometimes widely varying, land management objectives and emphases. Many of the plans were based on the assumption that ecological conditions were healthy, or that disturbances (such as fire, insects, and disease) would not substantially affect planned actions, desired outcomes, or outputs. In general, the intent is to provide sustainable levels of resources (such as timber and wood products, livestock forage, big game and game birds, and minerals) in an environmentally prudent manner from some areas. Other areas are managed as wilderness or wilderness study areas, scenic areas, research natural areas, unroaded lands, and conservation areas to provide other uses and values such as aesthetics, recreation opportunities, viewable wildlife, and clean air and water.

Design and Architecture of Alternative S1

Alternative S1, the no-action alternative, represents all the various land use plans in the project area. These plans were developed at different times by two agencies in several regions using different definitions and policies. The plans vary tremendously, each plan was written at a much smaller scale than the ICBEMP, and each were developed using different goals than the ICBEMP. An attempt was made to make Alternative S1 parallel to the other alternatives; however, it is described and presented somewhat differently than Alternatives S2 and S3. For example, Alternative S1 is organized by the four major components, just as Alternatives S2 and S3 are (landscape succession/disturbance; terrestrial species habitat; aquatic habitat; and human needs, products, and services). However, it does not have a comprehensive restoration strategy, and there are no aquatic (A1 and A2 subwatersheds) or terrestrial (T watersheds) habitats delineated. Therefore, since it was neither appropriate nor possible to include all direction from individual plans, relevant items were consolidated and paraphrased.

Management Direction

Forestland Vegetation Management

The general intent of forestland vegetation management is to rely on even-aged management practices, favor early seral species with reduced stand densities, improve growth and yields, restore and maintain soil productivity, use genetically improved trees to prompt reforestation, and reduce fuel loads. In the past, lands suitable for timber production were managed at the stand level; however, policy changes, interim strategies, and Biological Opinions have affected forestland management so management activities are planned at watershed scales more than at the stand level, uneven-aged practices are emphasized more, and timber harvest is reduced within riparian areas and priority watersheds.

Rangeland Vegetation Management

The intent of vegetation management on rangelands is focused on providing forage for livestock and wildlife, while protecting soil productivity and coordinating with other resource uses. Control and prevention of noxious weeds and management of non-native plants is gaining importance as a management intent. Healthy Rangelands direction for BLM-administered lands, interim strategies, and Biological Opinions have increased the focus on vegetation and soil conditions and protection of aquatic and riparian values.

Wildlife Habitat Management

The intent of wildlife habitat management is to develop effective wildlife habitat (primarily big game and other game animal habitat) by managing vegetation conditions and distribution of roads. Certain key habitats and habitat components, such as late/old growth forests and snags and downed wood, are

generally planned to exist at relatively low levels—often the minimum required to maintain species viability, although the importance of these habitat components has been enhanced in eastern Oregon and eastern Washington forests because of the Eastside Screens.

The intent of managing aquatic/riparian resources has been modified by requirements in PACFISH, INFISH, and the Biological Opinions

Aquatic/Riparian Management

Each land use plan generally has direction for aquatic and riparian management. The intent of managing aquatic/riparian resources has been modified by requirements in PACFISH, INFISH, and the Biological Opinions, which provide a consistent approach to aquatic habitat management for most of the project area. The requirements include:

- Establishing Riparian Habitat Conservation Areas and Riparian Management Objectives;
- Incorporating standards and guidelines for resource management applied to riparian conservation areas and upland areas affecting riparian areas;
- Designating priority watersheds and specific subbasins for protection/restoration activities;
- Using subbasin analyses and Ecosystem Analysis at the Watershed Scale;
- Focusing watershed restoration on degraded habitats to improve long-term conditions; and
- Applying terms, conditions, and conservation recommendations to watersheds with listed aquatic species habitats, priority watersheds, or specific subbasins.

Restoration

Restoration of vegetation and succession/disturbance regimes usually are not a priority in existing land use plans. In general, restoration activities such as thinning, prescribed fire, decreased road densities, and watershed restoration occur at relatively low levels. Restoration priorities are set locally, not regionally. The interim strategies and Biological Opinions have increased the focus on restoration of aquatic and riparian resources, and of forest vegetation in eastern Oregon and eastern Washington forests. They have also increased the emphasis on prioritizing restoration beyond the bounds of individual administrative units.

Alternative S2

Theme

Alternative S2 focuses on restoring and maintaining ecosystems across the project area and providing for the social and economic needs of people, while reducing short- and long-term risks to natural resources from human and natural disturbances. An emphasis on conducting analyses, such as Subbasin Review and Ecosystem Analysis at the Watershed Scale (EAWS), prior to conducting management activities is intended to minimize short-term risk from management activities in areas where short-term risks are of most concern, and to ensure actions occur in the most appropriate locations in the most appropriate sequence. In this way, Alternative S2 systematically minimizes short-term risks from management activities or disturbance events. Economic participation of the local workforce in management activities is promoted by ensuring restoration activities are prioritized to occur in areas that are economically specialized in industries tied to goods and services from Forest Service- and BLM-administered lands.

Restoration activities are planned and conducted across the project area to effectively and efficiently address the long-term risks associated with disturbance events. Restoration in certain areas is prioritized based on: areas that have high risk to terrestrial and aquatic habitats of unnaturally severe disturbance and high or moderate opportunity to address those risks (for example through the ability to connect and expand scarce aquatic and terrestrial habitats). In addition, some of these areas are near isolated and economically specialized communities, and therefore have opportunity to provide economic value to human communities.

In addition to promoting the broad-scale restoration and maintenance of ecosystems, conservative direction is also provided to further promote the protection of specific subwatersheds containing important fish populations and specific watersheds containing important terrestrial source habitats. These are the habitats that have declined the most (in geographic extent) from historical to current periods, and therefore, they are in short supply. Management is designed to conserve these habitats by avoiding short-term risks to them, while expanding them elsewhere through restoration actions.

Design/Architecture of Alternative S2

Management direction in Alternative S2 is hierarchical in that some types of direction take precedence over others. ICBEMP direction may be basin-wide (applies to all Forest Service- and BLM-administered lands in the project area), geographic (applies to certain mapped or described areas), or conditional (applies wherever particular conditions are found).

The design or architecture of Alternative S2 includes four main elements:

1. **Integrated Management Direction** includes base level, restoration, and geographically specific direction, which addresses landscape dynamics, terrestrial source habitats, aquatic species and riparian and hydrologic processes; and social-economics and tribal governments;
2. A **Step-Down** process to bring broad-scale management direction and scientific findings to national forests and BLM districts;
3. **Adaptive Management**, which allows modification of management direction to incorporate new knowledge and understandings; and
4. **Monitoring and Evaluation** to ensure management activities are achieving desired results.

Integrated Management Direction

The management direction in Alternative S2 is designed to address four major broad-scale ecosystem components: landscape dynamics; terrestrial source habitats; aquatic species and riparian and hydrologic processes; and social-economics and tribal governments. The direction is organized to integrate the interconnections among these components. The intent of the management direction—which includes objectives, standards, and guidelines—is summarized below. The management intent and management direction for Alternative S2 are presented in full later in this chapter.

Landscape Dynamics

The landscape dynamics component of the integrated ecosystem management strategy was developed to maintain ecosystems that are in good condition, and to restore ecosystems that are degraded on Forest Service- and BLM-administered lands. The intent of management direction for **landscape dynamics** is to maintain or, if necessary, restore the health, productivity, and diversity of native fish, wildlife, and plants; maintain or improve water quality; sustain stream flows; and maintain and/or enhance the resiliency of forests and rangelands to fires, disease, and other disturbances. This direction provides the foundation for managing long-term risk to fish, wildlife, and plant species and habitats, and social-economic needs (including tribal rights and interests). It provides the thread that connects and integrates the individual components. Management direction for landscape dynamics can be found in the base level, restoration, and terrestrial T watershed sections; however, direction for aquatic A1 and A2 subwatersheds also contributes to the maintenance and restoration of landscape dynamics.

One intent of managing native plant communities is to slow the rapid spread of **noxious weeds** using an integrated weed management strategy. Another intent is to protect and enhance vegetation types that are in short supply and are important to wildlife, such as **old forests**.

Management direction for fire and roads is included as part of landscape dynamics. The intent of direction for **fire management** is to improve vegetation conditions and reduce the threat of severe wildfire through the use of prescribed fire. Coordinating fire management with adjacent landowners is intended to increase the resiliency of forests and rangelands to severe wildfires while also reducing the negative air quality impacts that are associated with severe wildfires.

Roads that are needed for land management, public access, and tribal rights are intended to be safe, promote efficient travel, and be improved as needed.

The overarching intent for **roads management** within the ICBEMP is to progress toward a smaller transportation system that provides public access, reduces road-related adverse effects, and can be maintained in the long term with minimal environmental impact. Roads that are no longer needed will be closed or obliterated and ecological values restored. Roads that are needed for land management, public access, and tribal rights are intended to be safe, promote efficient travel, and be improved as needed. New road construction will be reduced from past levels. The focus of road restoration is intended to occur where reduction of adverse effects and benefits to resources can be maximized—for example, along valley bottoms and main river corridors where species are negatively affected by human disturbance and habitat degradation associated with roads.

Terrestrial Source Habitat

The terrestrial component of the integrated ecosystem management strategy was developed to consider and provide habitat for productive and diverse populations and communities of plant and animal species; provide habitat capable of supporting harvestable resources; and provide for terrestrial habitats on Forest Service- and BLM-administered lands. The focus of the **terrestrial source habitat** direction is to change declining trends in terrestrial habitats by maintaining important vegetation characteristics (such as plant species composition, forest and rangeland vegetation structure, snags, and coarse woody debris) which various terrestrial species need to survive and reproduce. Management direction for terrestrial source habitat can be found in the base level, restoration, and terrestrial T watersheds sections.

Terrestrial T watersheds were identified because they contain source habitat for one or more of five "Families" of terrestrial species. Terrestrial species in these Families in general represent those for which source habitats have declined the most from historical to current periods in the project area. In addition, the pattern of source habitats within these watersheds is most similar to that historically found. T watersheds are an important, but not the only, component of the terrestrial habitat strategy. In the short term, the intent of managing source habitats, especially in T watersheds, is to conserve habitats with old-forest characteristics and those that have shown the greatest decline in geographic extent from what they were historically and therefore are in short supply. In the long term, the overall intent is to increase the geographic extent and connectivity of these same habitats, and to have a sustainable mix and pattern of habitats, which should contribute to the long-term persistence of terrestrial species.

Aquatic Species and Riparian and Hydrologic Processes

The aquatic/riparian/hydrologic component of the integrated ecosystem management strategy was developed to maintain and restore the health of watersheds and aquatic ecosystems on Forest Service- and BLM-administered lands. It focuses on maintaining and restoring watershed conditions, water quality, and aquatic and riparian habitat by replacing interim strategies (PACFISH and INFISH), and addressing long-term aquatic species viability, short- and long-term risks to these resources from management activities, and long-term risks from uncharacteristically severe natural disturbances. Geographically specific areas, such as riparian conservation areas (RCAs), aquatic A1 subwatersheds, and aquatic A2 subwatersheds, are important components of the aquatic strategy. Management direction for aquatic/riparian/hydrologic resources can be found in the base level, restoration, aquatic A2 subwatersheds, and aquatic A1 subwatersheds sections. In addition, management direction for landscape dynamics and terrestrial source habitats is intended to enhance aquatic/riparian/hydrologic resources.

RCAs, A1 subwatersheds, and **A2 subwatersheds** were identified because of their importance to fish, riparian-dependent species, water quality, and other aquatic, riparian, or hydrologic resources. The management intent in these areas is to protect these resources in the short term and improve them in the long term. Protection and enhancement of these areas is intended to contribute to a network of connected aquatic/riparian habitats and enhance the long-term persistence of aquatic and riparian-dependent species.

Socio–Economic and Tribal Considerations

The socio-economic-tribal component of the integrated ecosystem management strategy was developed to support the economic and social needs of people, cultures, and communities of the interior Columbia Basin, and to provide for sustainable levels of products and services from lands administered by the Forest Service and BLM within the capabilities of the ecosystem. It focuses on producing **products and services** from public lands to encourage and support people's use of public land resources within the capacity of ecosystems to provide sustainable levels of products and services, consistent with other ecological and restoration goals. Another intent is to support economic activity for local and tribal communities, particularly those that are isolated and economically specialized, which will help maintain their viability as they move toward achieving their long-range goals of economic development and broader economic diversification. Management direction that specifically addresses this component can be found in base level and restoration sections.

The socio-economic and tribal government direction promotes agency support for, and collaboration with, local communities and tribal governments when developing methods to support their **social and economic needs**. Another intent is to integrate the needs of local and tribal communities more thoroughly into agency decision-making and management activities.

The **socio-economic-tribal restoration** direction highlights areas where restoration activities have a direct influence on human community economic, social, and cultural needs. This direction is linked to restoration direction provided in the landscape dynamics, terrestrial, and aquatic/riparian/hydrologic sections; it relates to considerations for designing and implementing restoration activities that are intended to promote workforce participation, serve demands for commodity products at various levels, encourage intergovernmental collaboration, and consider tribal needs and interests.

The intent of management direction for **federal trust responsibility and tribal rights and interests** is to address as fully as possible tribal concerns and interests and to reflect consideration of federal legal responsibilities both to tribes and American Indian people as expressed through treaty language, federal laws, executive orders, and federal court judgements.

Step-down

Step-down is the process of applying broad-scale science ICBEMP findings and management direction to site-specific activities on national forests and BLM districts.

Four levels of analysis make up this step-down process:

- Subregional analysis (BLM resource management plans or Forest Service land and resource management plans);
- Mid-scale analysis (Subbasin Review);
- Fine-scale analysis (Ecosystem Analysis at the Watershed Scale);
- Site-specific NEPA analysis (environmental analysis or environmental impact statement).

The Supplemental Draft EIS proposes direction for mid-scale analysis (Subbasin Review) and fine-scale analysis (Ecosystem Analysis at the Watershed Scale). Forest Service and BLM direction already exist for the development of resource management plans and site-specific NEPA analysis.

The intent of conducting these analyses in this step-down manner is to reduce overall short-term and long-term risks to resources from human and natural disturbances, while maximizing conservation and restoration opportunities. For example, broad-scale or regional resource risks are addressed through the Supplemental Draft EIS, subregional resource risks are addressed through land use plans, mid-scale or landscape resource risks through Subbasin Review and/or EAWS, and site-specific resource risks through site-specific NEPA analysis.

In *Alternative S2*, there is greater emphasis on conducting analyses (Subbasin Review and EAWS) prior to conducting management activities in certain areas, which is intended to minimize the short-term risks posed by the activities and to assist in determining the most appropriate location and sequence of activities.

Adaptive Management

The intent of adaptive management is to incorporate and build on current knowledge, observation, experimentation, and experience to adjust management methods and policies, and to accelerate learning. The intent is for management direction to be modified if a site-specific situation is different than what was assumed during ICBEMP planning; if a flood, fire, or other event changes the characteristics of the environment; if new information gathered through monitoring indicates objectives are not being met; or if new science information indicates a need for change. Accelerated learning is intended to occur from formal research designed to test hypotheses of scientifically uncertain and/or controversial management issues, or to use field trials to test the usefulness of new strategies to achieve objectives.

Monitoring and Evaluation

Monitoring and evaluation are an integral part of adaptive management and are key to achieving the short- and long-term goals and objectives of the ICBEMP. Success in meeting ICBEMP goals and objectives requires that the effects of this outcome-based direction be monitored and evaluated in a timely manner to determine if modifications are needed.

The monitoring and evaluation porcess is intended to:

- Focus on ICBEMP goals and objectives to guide key elements to monitor;
- Be developed collaboratively using an intergovernmental, interdisciplinary team;
- Address linkages and relationships among scales in the project area;
- Be based on scientific understandings of interactions among ecosystem components and human activities; and
- Be technically feasible, affordable, and operationally attainable.

Alternative S3

Theme

Alternative S3 focuses on restoring and maintaining ecosystems across the project area and providing for the social and economic needs of people, while reducing short- and long-term risks to natural resources from human and natural disturbances. Because managers must take some short-term risks to address long-term risks of disturbance events, some short-term risk is acceptable within the requirements of the Endangered Species Act, Clean Water Act, and Clean Air Act. Minor emphasis is put on conducting Subbasin Review and Ecosystem Analysis at the Watershed Scale (EAWS) prior to conducting management activities. Management activities are linked to areas where they can benefit isolated communities that are economically specialized in industries tied to goods and services from Forest Service- and BLM-administered lands.

Restoration activities are planned and conducted across the project area to address the long-term risks associated with unnaturally severe disturbance events.

Restoration activities are planned and conducted across the project area to address the long-term risks associated with unnaturally severe disturbance events. Restoration is prioritized in certain areas based on: disturbance/succession regimes and other measures of landscape dynamics; ability to connect and expand scarce aquatic and terrestrial habitats; hydrologic processes; and economic value to human communities.

In addition to promoting the broad-scale restoration and maintenance of ecosystems, conservative direction is also provided to further promote the protection of specific subwatersheds containing important fish populations and specific watersheds containing important terrestrial source habitats. These are the habitats that have declined the most (in geographic extent) since that historically found, and therefore, they are in short supply. Management is designed to conserve these habitats by avoiding short-term risks to them, while expanding them elsewhere through restoration actions.

Design/Architecture of Alternative S3

The design/architecture of Alternative S3 is the same as for Alternative S2.

Integrated Management Direction

Landscape Dynamics

The intent of management direction for the landscape dynamics component is the same as that under Alternative S2 with the following exceptions:

> In *Alternative S3*, there is a greater emphasis on conducting more immediate actions to address long-term risks to resources from unnaturally severe disturbance.

Terrestrial Source Habitats

The intent of management direction for the Terrestrial Source Habitats is the same as that under Alternative S2.

Aquatic Species and Riparian and Hydrologic Processes

The intent of aquatic/riparian/hydrologic direction is the same as that under Alternative S2 with the following exceptions:

> *In Alternative S3*, there are fewer acres that are delineated as aquatic A1 and A2 subwatersheds and riparian conservation areas (RCAs).

Socio-economic–Tribal Considerations

The intent of the socio-economic-tribal management direction is the same as under Alternative S2 with the following exceptions:

> *Alternative S3* promotes the economic participation of the local workforce in management activities by prioritizing activities near communities that are less economically diverse and more economically specialized in outputs of goods and services from Forest Service and BLM-administered lands, and near tribal communities.

Step-down

The intent of step-down under Alternative S3 is the same as that under Alternative S2, with the following exceptions:

> In *Alternative S3,* there is less of an emphasis to complete EAWS prior to conducting management activities. Instead, the intent is to prioritize and schedule EAWS and any other necessary analysis during Subbasin Review.

Adaptive Management

The intent of adaptive management under Alternative S3 is the same as that under Alternative S2.

Monitoring and Evaluation

The intent of monitoring and evaluation under Alternative S3 is the same as that under Alternative S2.

Selection of the Preferred Alternative

The preferred alternative identified by the Regional Executive Steering Committee as "preferred" among all those considered (this includes the seven alternatives presented in the Eastside and Upper Columbia River Basin Draft EISs and the three alternatives presented in the ICBEMP Supplemental Draft EIS) is Alternative S2. The preferred alternative identified in this Supplemental Draft EIS replaces the preferred alternative identified in the Draft EISs (Alternative 4). The change in the preferred alternative was influenced by the 83,000 comments received on these Draft EISs, new scientific information, and feedback from the land management agencies, intergovernmental and interagency partners, and the Congress. The focus for the preferred alternative was refined as described in a letter from the Secretaries of Agriculture and the Interior to the northwestern congressional delegation (October 1998).

Alternative S2 was identified as the preferred alternative because, out of the 10 alternatives that were considered in the Draft and Supplemental Draft EISs, the ICBEMP regional executives feel it responds best to the purpose and need statements (in Chapter 1) and the five goals (later in this chapter) under the refined focus of the project. They agreed that it would provide the strongest and best strategy for: restoring the health of the forests, rangelands, and aquatic-riparian ecosystems in the project area; recovering plant and animal (including fish) species; avoiding future species listings; and providing a pre-dictable level of goods and services from the lands administered by the BLM and the Forest Service.

The regional executives considered several factors in coming to this conclusion. These include:

- meets the purpose and need statement for the project,
- consistency with Endangered Species Act requirements and recovery plans,
- includes a strategy that is intended to preclude further listings of species,
- addresses agencies' tribal treaty and trust responsibilities,
- implementable at reasonably foreseeable funding levels,
- consistent with and founded on science,
- provides for implementation accountability,
- provides for implementation clarity such that management actions will result in the predicted and desired outcomes,
- degree of likelihood of broad public support for implementation, and
- meets the intent of applicable federal and state laws.

The regional executives also reviewed the SAG and EIS team analysis of the effects of the alternatives, which are disclosed in Chapter 4.

In coming to consensus on Alternative S2 as the preferred alternative, the regional executives modified early working drafts of management direction to more explicitly explain that the identified opportunities/priorities for restoration activities would be further prioritized at finer scales to ensure the first restoration activities would be linked to areas with potential to benefit local communities. This change is reflected in the direction for Alternative S2. With this clarification, the regional executives concurred that they would present Alternative S2 as their preferred alternative in the Supplemental Draft EIS.

In the Final EIS and Record of Decision (ROD), the decision makers may modify the preferred alternative, incorporate elements of the various alternatives analyzed in the Draft EIS and Supplemental Draft EISs, or even select a different alternative as the preferred alternative. Before issuing the Final EIS and ROD, the Regional Executives will consider additional

analysis of, and changes to, the preferred alternative. The option of incorporating elements of the no-action alternative (Alternative S1) is particularly relevant to the transition from current direction of PACFISH, INFISH, and the Biological Opinions to a long-term management strategy. The effectiveness of Alternative S2 depends on an implementation strategy that uses the existing Federal Land Policy and Management Act and National Forest Management Act planning process and National Environmental Policy Act decision-making process to translate objectives and standards on an ecosystem scale into watershed- and site-specific criteria that local managers can apply when designing particular projects and activities. This implementation strategy is supported by step-down processes, such as Subbasin Review and Ecosystem Analysis at the Watershed Scale.

This transition phase begins when the ROD is signed. This period will vary for different elements of direction and different subbasins and watersheds. While some elements of Alternative S1 are already contained in Alternative S2, particularly as interim and default standards, the decision makers may consider retaining additional elements of Alternative S1 for the transition phase. Prior to issuance of the ROD, additional work will be done on this transition strategy to determine whether and how elements of Alternative S1 should be carried forward in the transition phase for the preferred alternative.

The final transition strategy is not expected to result in effects that fall outside the range of effects described for the alternatives in this Supplemental Draft EIS. Indeed, the Regional Executives have agreed that the purpose of this additional work is to clarify and focus the preferred alternative to ensure that the effects of the transition strategy, upon implementation, are consistent with the effects described herein. Comment on this topic is encouraged.

Alternative S1 (No-Action)

Introduction

Analysis of a no-action alternative is a requirement of the National Environmental Policy Act (NEPA) and BLM and Forest Service planning procedures. Information for the no-action alternative was derived from individual land use plans currently being implemented by the BLM or the Forest Service in the project area, including interim direction (PACFISH, INFISH, Eastside Screens) that has been in place for at least four years. The interim direction was developed to retain options for management of affected federal lands while the long-term strategy addressed through the ICBEMP environmental impact statement was being developed. The no-action alternative was presented in the Draft EISs as Alternative 2. It was revised and is presented in this Supplemental Draft EIS as Alternative S1.

Interim strategies (INFISH, PACFISH, and Eastside Screens) are presented in detail in the no-action alternative because one of the primary purposes for the ICBEMP project is to provide long-term management direction to replace these interim strategies.

The no-action alternative was presented in the Draft EISs as Alternative 2. It was revised and is presented in this Supplemental Draft EIS as Alternative S1.

Major Changes from the Draft EISs

The no-action alternative was revised from the Draft EISs to incorporate terms and conditions, reasonable and prudent measures, and conservation recommendations from the U.S. Fish and Wildlife Service and National Marine Fisheries Service Biological Opinions on the Land and Resource Management Plans as amended by PACFISH and INFISH (NMFS 1995, NMFS 1998, USFWS 1998). It also incorporates by reference the final standards for rangeland health and guidelines for livestock grazing management (known as the Healthy Rangelands Initiative) on BLM-administered lands in Montana, Idaho, Oregon, and Washington signed in 1997 (USDI BLM 1997a, b, c). Objectives and standards have been reorganized to facilitate comparison to action alternatives S2 and S3.

Other components of the direction associated with the no-action alternative (such as Healthy Rangelands, or specific recovery plans) are not expected to be changed directly by ICBEMP decisions and are not presented in as much detail.

To provide a point of comparison for the ICBEMP action alternative(s), relevant items from the individual plans were consolidated and paraphrased into a theme and management direction; therefore the exact language used in Alternative S1 may not appear in individual plans. The resulting Alternative S1 is reasonably representative of those parts of existing plans that correspond to broad-scale direction being proposed in the ICBEMP EIS.

The implementation budget presumed for the aggregation of existing plans represented by Alternative S1 is the current funding level, not the aggregation of their proposed budgets.

If Alternative S1 were selected for implementation, then existing land use plans would continue as currently written and PACFISH, INFISH, and the Eastside Screens would remain direction in those areas where they are currently interim.

Alternative S1 Description and Management Intent

In the no-action alternative, Forest Service- and BLM-administered lands throughout the project area would continue to be managed by direction in existing land use plans, recovery plans, and other current direction related to threatened or endangered species. There are currently 64 land use plans, from 6 to 21 years old. These cover diverse ecosystems; each plan has distinct, and sometimes widely varying, land management objectives and emphases. Many of the plans were based on the assumption that ecological conditions were healthy, or that disturbances (such as fire, insects, and disease) would not substantially affect planned actions, desired outcomes, or outputs. Recognizing the diverse expectations within the existing plans, the following description and management intent is intended to display general expectations so that comparisons can be made with the other alternatives.

Specific ***interim direction*** that affects existing management direction is described in the following decision notices and biological opinions:

- Implementation of Interim Strategies for Managing Anadromous Fish-producing Watersheds in Eastern Oregon and Washington, Idaho, and Portions of California *(PACFISH)*, February 24, 1995, as amended by the Forest Service September 11, 1996 and by the BLM January 31, 1997.
- Inland Native Fish Strategy (*INFISH*), July 28, 1995.
- Interim Management Direction Establishing Riparian, Ecosystem and Wildlife Standards for Timber Sales (*Eastside Screens*), May 20, 1994; amended June 5, 1995; riparian standards were replaced July 31, 1995. Applies to all or parts of the following National Forests located in eastern Oregon and Washington: Colville, Deschutes, Fremont, Malheur, Ochoco, Okanogan, Umatilla, Wallowa-Whitman and Winema national forests. PACFISH and INFISH are used as the riparian screen requirement.
- *Biological Opinion*: Land and Resource Management Plans for the: Boise, Challis, Nez Perce, Payette, Salmon, Sawtooth, Umatilla, and Wallowa-Whitman National Forests. National Marine Fisheries Service, Northwest Region. Issued March 1, 1995. [Snake River spring-summer chinook, Snake River fall chinook, and Snake River sockeye salmon]
- *Biological Opinion*: Land and Resource Management Plans for National Forests and Bureau of Land Management Resource Areas in the Upper Columbia River Basin and Snake River Basin Evolutionarily Significant Units. National Marine Fisheries Service, Northwest Region. Issued June 19, 1998. [Listed Snake River chinook and sockeye salmon, and Snake River and Upper Columbia River steelhead trout]
- *Biological Opinion* for the Effects to Bull Trout from Continued Implementation of Land and Resource Management Plans and Resource Management Plans as Amended by the Interim Strategy for Managing Fish-producing Watersheds in Eastern Oregon and Washington, Idaho, Western Montana, and Portions of Nevada (INFISH), and the Interim Strategy for Managing Anadromous Fish-producing Watersheds in Eastern Oregon and Washington, Idaho, and Portions of California (PACFISH). U.S. Fish and Wildlife Service, Regions 1 and 6. Issued August 14, 1998. [Bull trout]

In the existing land use plans, lands administered by the BLM or Forest Service are generally intended to provide a mix of natural resource-based goods and services. Management direction focuses on providing sustained levels of resource outputs including timber and wood products, livestock forage, big game and game birds, and minerals in an environmentally prudent manner, while also providing for other uses and values such as aesthetics, recreation opportunities, viewable wildlife, and clean air and water. Portions of the landscape are used for commodity production. Other areas are allocated as wilderness or wilderness study areas, scenic areas, research natural areas, unroaded lands, and conservation areas.

In many current plans, lands suitable for timber production are managed at the stand level. The plans rely on even-aged management practices, favoring early seral species with reduced stand densities, improved growth and yields, restored and maintained soil productivity, and prompt reforestation achieved by using genetically improved trees. Prescribed fire and thinning are also used to manage vegetation and reduce fuel loads and ladders. Subsequent changes in policy, the interim strategies, and Biological Opinions have affected forestland management direction. Management activities now are planned more at watershed scales than at the stand scale, with a shift toward uneven-aged practices where ecologically appropriate. Within riparian areas and watersheds identified as having "priority" for fish values, timber management is greatly reduced.

On rangelands, vegetation management is focused on providing forage for livestock and wildlife, while protecting soil productivity and coordinating with other resource uses. Control and prevention of noxious weeds is an important management intent, and the presence of non-native vegetation species is a management issue over large areas. The addition of Healthy Rangelands direction for BLM-administered lands, as well as interim strategies and Biological Opinions, has increased the focus on vegetation and soil conditions and protection of aquatic and riparian values.

Restoration of vegetation and succession/disturbance regimes are not a priority in existing land use plans. Planned restoration activities such as thinning, prescribed fire, decreased road densities, and watershed restoration are at relatively low levels, with some exceptions. Restoration priorities are set locally, with no intentional effort to coordinate restoration activities across the project area. The Eastside Screens use passive and active restoration in timber sale areas in eastern Oregon and Washington to achieve forest vegetation conditions (such as composition, density, structure, and pattern) that more closely resemble historical conditions for a given forest potential vegetation group. The interim strategies and Biological Opinions increase the focus on restoration of aquatic and riparian values and initiate a broad-scale effort to prioritize restoration beyond the bounds of individual administrative units.

In the no-action alternative, wildlife habitat management generally results from forest and range management activities. The emphasis in many existing plans is on developing effective wildlife habitat (primarily big game and other game animal habitat) by managing vegetation conditions and distribution of roads. Certain key habitats and habitat components such as late/old growth forests and snags and downed wood are generally planned to exist at relatively low levels (often the minimum) with the intent of maintaining species viability.

In eastern Oregon and Washington, wildlife management in areas supporting timber sales has been modified to incorporate the Eastside Screens. The Screens emphasize retaining/developing late/old structures and patch sizes within historical range of variability; maintaining or developing linkages between old forests; meeting requirements for snags, downed logs, and green tree replacements; retaining larger trees (larger than 21 inches diameter at breast height); and providing habitat for goshawks.

The no-action alternative requires protection of unique habitats and recovery of threatened or endangered species through the appropriate recovery process.

Until the addition of the PACFISH, INFISH, and Biological Opinions, management direction for riparian and aquatic resources focused on water quality and habitat components (pools, large wood, stable banks, and vegetation conditions) through application of Best Management Practices (BMPs). BMPs are a system of accepted practices designed to protect key resources or prevent undesirable impacts, while allowing for existing uses.

Aquatic requirements from PACFISH/INFISH and the Biological Opinions are incorporated throughout most of the project area, and provide a consistent approach to aquatic habitat management. The requirements include:

- Establishing Riparian Habitat Conservation Areas (RHCAs) and Riparian Management Objectives (RMOs);
- Incorporating standards and guidelines for resource management applied to riparian conservation areas and upland areas affecting riparian areas;

- Designating priority watersheds and specific subbasins for protection/restoration activities;
- Using subbasin analyses and Ecosystem Analysis at the Watershed Scale; and
- Focusing watershed restoration on degraded habitats to improve long-term conditions.

Alternative S1 Objectives, Standards, and Guidelines

To provide a point of comparison for the ICBEMP action alternative(s), relevant items from the 64 individual plans were consolidated and paraphrased into a theme and management direction. Direction is highly variable among the plans. The EIS Team compared items in the existing plans that correspond to the broad-scale direction being proposed in the ICBEMP EIS, and made an effort to interpret whether the intent of the direction most closely paralleled the project's definitions of "objective," "standard," or "guideline" (see Key Terms box earlier in this section). Although the exact language used in Alternative S1 may not appear in individual plans, the resulting Alternative S1 is reasonably representative of those parts of existing plans at the broad scale that correspond to direction being proposed in the ICBEMP EIS.

Step-Down, Adaptive Management, and Monitoring and Evaluation

S1-O1. Objective. Make appropriate adjustments in management strategies as new information, technology, and social desires are identified.

Rationale: Adaptive management is a continuing process of action-based planning, monitoring, researching, evaluating, and adjusting standards and techniques to improve achievement of the ICBEMP goals and objectives. These standards and techniques are based on scientific knowledge. Ecosystem management uses an adaptive approach and calls for applying the latest scientific information and professional judgement to develop management plans that will most likely meet desired conditions. To be successful, it must have the flexibility to adapt and respond to new information. Under the concept of adaptive management, new information will be evaluated and decisions made whether to make adjustments or changes as experience is gained from implementing plans. The adaptive management approach will enable resource managers to determine how well management actions meet their objectives and what steps are needed to modify activities to increase success or improve results.

S1-O2. Objective. For riparian areas, set measurable objectives and monitoring for key parameters such as stream surface shading, streambank stability, and shrub cover.

S1-S1. Standard. Ensure that management activities comply with appropriate regulations and that inspections are conducted in accordance with agency policies and procedures.

S1-O3. Objective. Assess the effects of management strategies by monitoring changes in conditions, and take actions as needed to meet plan objectives.

Rationale: Monitoring allows detection of undesirable and desirable changes so that management actions can be modified or designed to achieve desired goals and objectives while avoiding adverse effects to ecosystems. Note: Current Forest Service and BLM monitoring programs within the project area are not systemically designed to provide monitoring information needed to evaluate management plans at multiple planning scales. The Biological Opinions (summarized in S1-BO1 through S1-BO80) provide additional direction for aquatic and riparian monitoring that will address multiple planning levels.

Terrestrial Habitats and Landscape Dynamic Components

Ecosystem Processes and Functions

Soils

S1-O4. Objective. Plan and conduct land uses and management activities to minimize loss of site potential caused by detrimental erosion, compaction, displacement, puddling, and severe burning.

S1-O5. Objective. Maintain at least 80 percent of each area directly affected by management activities in condition of acceptable productivity potential.

S1-O6. Objective. Use management practices that ensure:

- adequate amounts of ground cover to support infiltration, maintain soil moisture storage, and stabilize soils;
- permeability rates appropriate to climate and soils; and
- adequate nutrient capital and functioning cycles.

S1-O7. Objective. Where detrimental effects have occurred, plan and implement rehabilitation to meet soil and water objectives and standards.

S1-O8. Objective. Stabilize lands disturbed as a result of soil erosion control activities.

Noxious Weeds

S1-O9. Objective. Integrate noxious weed management into project and activity planning to contribute to the prevention, detection, control, and eradication of noxious weeds.

S1-S2. Standard. Plans and actions for control of competing and unwanted vegetation (including noxious weeds) shall be consistent with *Managing Competing and Unwanted Vegetation* (USDA/Forest Service 1988), *Vegetation Treatment on BLM Lands in Thirteen Western States* (USDI/BLM 1991b), *Northwest Area Noxious Weed Control Program* (USDI/BLM 1987), or similar agency direction.

Fire Management and Air Quality

S1-O10. Objective. Manage wildland fire to protect human life and property and to minimize loss of resource values.

S1-S3. Standard. Wildfires shall receive a prompt and appropriate suppression response, as defined by the agency.

S1-S4. Standard. Priorities for fire suppression shall be the protection of human life, public safety, private property, and improvements or investments.

S1-G1. Guideline. Minimum impact suppression methods can be used.

S1-G2. Guideline. Prescribed fire can be used to meet vegetation management objectives and to reduce and maintain appropriate fuel profiles. Unplanned ignition may be used if a prescribed fire plan has been developed and the fire is within prescription.

S1-G3. Guideline. Consider managing fuel residue profiles at a level to minimize the potential of high intensity catastrophic wildfire and provide for other resource objectives.

S1-O11. Objective. Meet state air quality requirements.

S1-S5. Standard. Prescribed burning shall be planned and conducted in accordance with State Smoke Management Plans and State Implementation Plans of the Clean Air Act.

S1-G4. Guideline. Smoke management mitigation measures may be used to reduce emissions from prescribed burning.

S1-S6. Standard. Reduce total emissions from prescribed burns to prevent significant deterioration.

S1-G5. Guideline. Prescribed fire and other fuels management may be used to reduce the potential for wildfire emissions.

Road Management

[NOTE: Additional road management items are listed under the Biological Opinions sections, Road Evaluation and Planning, and Road Construction Actions.]

S1-O12. Objective. Provide and maintain reasonable access to National Forest System and BLM-administered lands.

Forestlands

S1-O13. Objective. Use timber management activities to promote horizontal and vertical vegetation diversity to help meet wildlife, aesthetic, recreational, and other objectives.

S1-S7. Standard. Allow regulated timber harvest only on lands classified as suitable for timber management. Prohibit timber harvest on lands unsuitable for timber management, except where needed to accomplish other multiple-use objectives.

S1-S8. Standard. Selection of appropriate silvicultural systems should:

- Meet the management objectives and management area or resource emphasis;
- Permit the production of a volume of marketable trees sufficient to use all trees that meet utilization standards defined in agency guidelines and designated for harvest;
- Permit the use of acceptable logging methods that can remove logs and other products without excessive damage to the identified desirable retained vegetation;
- Be capable of meeting or providing special management conditions and achieve particular multiple-use management objectives (such as streamside protection, wildlife needs, and visual enhancement);
- Permit vegetation control and use appropriate practices to establish desired species, composition, density, and rates of growth of trees and other vegetation needed to achieve objectives;
- Promote stand structures and species composition that minimizes serious risk of damage caused by mammals, insects, disease, or wildfire, and allows treatment of existing insect, disease, or fuel conditions;
- Assure that lands can be adequately restocked within time frames; and
- Be practical and economical in terms of transportation, harvesting, preparation, and administration of timber sales.

S1-S9. Standard. Clearcutting should occur only when it is found to be the optimum harvest method.

S1-G6. Guideline. The variety of management intensities and silvicultural practices can be used, singly or in combination, and will vary by site conditions and productivity, timber species, resource management objectives and timing of implementation.

S1-G7. Guideline. Appropriate silvicultural practices can include site preparation, tree improvement, reforestation, release and weeding, thinning, fertilizing, pruning, sanitation harvest, salvage harvest, even-aged harvests (shelterwoods, seed tree, clearcuts), and uneven-aged harvest (individual tree or group selection). Regeneration and tree stocking standards are defined at the local area.

S1-S10. Standard. Lands scheduled for timber harvest using even-aged practices (such as seed tree harvest or clear-cutting) should be managed so that harvest occurs near the point at which growth is maximized (also known as culmination of mean annual increment of growth).

S1-S11. Standard. Where appropriate, stagger regeneration in space and time for even-aged areas. Created openings should be separated by blocks of land or areas not classified as a created opening. Harvested areas are not considered a created opening for timber management when tree stocking is above minimum levels, and when trees are four feet tall and free to grow.

S1-S12. Standard. Openings created by even-aged harvesting should not exceed 40 acres; exceptions are permitted under catastrophic conditions.

S1-O14. Objective. Provide for salvage harvest of timber killed or damaged by events such as wildfire, wind storms, insect and diseases, consistent with management objectives for other resources.

Forest Vegetation: Eastside Screens

The following objectives and standards described for the Eastside Screens would be applicable to Forest Service-administered lands located in eastern Oregon and Washington.

S1-S13. Standard. Timber sales shall be designated to incorporate interim standards for ecosystem analysis and management (some types of timber sales are exempt from consideration under this standard).

S1-S14. Standard. The following ecosystem characterization and analysis process shall be used:

- Characterize the proposed timber sale and its associated watershed for patterns of stand structure by biophysical environment and compare to the historical range of variability.
- Use the processes and ecosystem characterization steps defined in Appendix B of Eastside Screens (USDA/Forest Service 1994, revised 1995).
- Identify structural components and biophysical environment combinations that are outside historical range of variability conditions to determine potential treatment areas.

Old Structure, Snags, Coarse Woody Debris: Eastside Screens

The following objectives and standards described for the Eastside Screens would be applicable to Forest Service-administered lands located in eastern Oregon and Washington. In addition to these items, individual land use plans have specific snags/coarse woody debris direction that was developed during the past 6 to 21 years for individual administrative units.

S1-S15. Standard. For timber sales the following process shall be used:

- Use Scenario A whenever any one type of late and old structure in a particular biophysical environment is below historical range of variability.
- Use Scenario B when both late and old structural stages within a particular biophysical environment are at or above historical range of variability.
- Late and old structure can be either multi-story with large trees or single-story with large trees.
- Late and old structure stages are calculated separately.

S1-O15. Objective. Scenario A: If either one or both of the late and old structural stages fall below historical range of variability in a particular biophysical environment within a watershed, manage to ensure no net loss of late and old structure from that biophysical environment.

S1-S16. Standard. Scenario A: Timber sale harvest activities shall not be allowed to occur within late and old structure stages that are below historical range of variability. Harvest of dead trees may be permitted when standards for snags and downed logs are met.

S1-G8. Guideline. Scenario A: Some timber sale activities can occur within late and old structure stages that are within or above historical range of variability in a manner to maintain or enhance late and old structure within that biophysical environment. One type of late and old structure may be manipulated to move stands into the late and old structure stage that is deficit if this meets historical conditions.

S1-O16. Objective. Scenario A: Outside of late and old structure, maintain and/or enhance late and old structure components in stands subject to timber harvest activities.

S1-S17. Standard. Scenario A: For timber sales in conditions outside late and old structure, the following shall be adhered to:

- All remnant late and old seral and/or structural live trees that are currently greater than 21 inches diameter at breast height shall be maintained within stands proposed for harvest activities.
- Vegetation structure that does not meet late and old structural conditions shall be manipulated using treatments that move stands toward appropriate late and old structural conditions to meet historical range of variability.
- Open, park-like stand conditions shall be maintained where this condition occurred historically. Manipulate vegetation to encourage the development and mainte-

nance of large diameter, open canopy structure. (While understory removal is allowed, some amount of seedlings, saplings, and poles need to be maintained for the development of future stands).

S1-O17. Objective. Scenarios A and B: Maintain connectivity and reduce fragmentation of late and old structural stands.

S1-S18. Standard. The current level of connectivity between late and old structural stands and forest plan-designated "old growth" habitats should be maintained or enhanced by maintaining stands between them that serve the purpose of connections, using criteria for network pattern, connectivity corridor description, length of connection corridors and timber harvest and silvicultural criteria (Appendix B of Eastside Screens 1995).

S1-S19. Standard. Stands that do not currently meet late and old structure and that are surrounded by blocks of late and old structure should not be considered for even-aged regeneration or group selection. Non-regeneration or single tree selection in these areas should proceed only if the prescription moves the stand toward late and old structure condition.

S1-O18. Objective. Scenario B: Maintain wildlife habitat management options by affecting large and/or contiguous stands of late and old structure as little as possible, while meeting other multiple-use objectives.

S1-S20. Standard. Scenario B: Within a particular biophysical environment within a watershed, if the single, existing late and old structural stage is within or above historical range of variability, and if both types of late and old structural stages occur and both are within or above historical range of variability, then timber harvest can occur within these stages as long as late and old structural conditions do not fall below historical range of variability. Late and old structural conditions and attributes should be enhanced as possible, consistent with other multiple-use objectives.

Harvest activities (any and all types being considered) should occur in the following stand types in order of priority:

1. First priority is within stands other than late and old structure.
2. Second priority is within smaller, isolated late and old structural stands less than 100 acres and/or at the edges (first 300 feet) of large blocks of late and old structural stands (greater than 100 acres).
3. As a last priority some harvesting can occur within the interior of large, late and old structural stands (greater than 100 acres; beyond 300 feet from edge), but is limited to non-fragmenting prescriptions such as thinning, single-tree selection (uneven- aged management), salvage, understory removal, and other non-regeneration activities. Group selection (uneven-aged management) is allowed only when created openings either resemble natural forest pattern openings and/or do not exceed 0.5 acre; regeneration harvest and group selection harvest that do not meet these conditions are not allowed.

S1-O19. Objective. Manage dead trees (snags) to provide the required numbers and size of snags throughout the forest to maintain primary cavity excavators at 40 to 60 percent of their potential population in timber production areas and appropriate levels in other areas; leave appropriate levels of green trees to serve as a source of future snags.

S1-S21. Standard. For timber sales, the following bullets refer to snags, downed logs, and green tree replacement habitats in timber sales (Appendix B of Eastside Screens, USDA/Forest Service 1994/revised 1995):

- Snags and green tree replacement trees greater than 21 inches diameter at breast height (or whatever is the representative diameter at breast height of the overstory layer if it is less than 21 inches) should be maintained at 100 percent potential population levels of primary cavity excavators.
- For lodgepole pine stands, all sale activities shall maintain snags and green replacement/roost trees of greater than 10 inches diameter at breast height at 100 percent potential population levels of cavity excavators. The largest available trees should be left to meet this requirement.
- Downed logs should be retained at appropriate quantities (see following table) while permitting accomplishment

Downed Log Requirements for S1-S21.

Species	Piece Length (feet)	Pieces per Acre	Small End Diameter (inches)	Total Linear Length (feet)
Ponderosa Pine	>6	3–6	12	20–40
Mixed Conifer	>6	15–20	12	100–140
Lodgepole Pine	>8	15–20	8	120–160

of fire protection needs for life and property and prescribed burning and without extraordinary measures to meet requirements.

- Pre-activity (currently existing) levels of downed logs should be left, unless they exceed the quantities listed in the following table. Harvest activities should supplement pre-activity levels of downed logs up to the maximum level shown below. Exceptions can be made where fire protection needs for life and property cannot be accomplished with this quantity of debris left on site.

S1-O20. Objective. Scenarios A and B: As a minimum, manage to ensure goshawk species viability by meeting Standard S1-S22; forest plan standards and guidelines that exceed the standards should be used instead of or in addition to Standard S1-S22.

S1-S22. Standard. Every known active and historical goshawk nesting site used in the past five years should be protected.

- Seasonal restrictions on activities near nest sites shall be required for activity types that may disturb or harass goshawk pairs while bonding and nesting.
- 30 acres of the most suitable nesting habitat surrounding all active and historical nest tree(s) shall be deferred from harvest.
- A 400-acre "Post Fledgling Area" shall be established around every known active nest site. While some harvest activities can occur within this area, retain at least 60 percent of the area in late and old structural condition or all the late and old structural stands if less than 60 percent should be retained. Enhance younger stands toward late and old structural condition, as possible.

Rangelands

S1-O21. Objective. Make suitable rangelands available for grazing and browse use in coordination with other uses and protection of productivity.

S1-S23. Standard. Manage vegetation on allotments or management areas to meet basic plant, plant vigor, and soil needs as first priority.

S1-S24. Standard. Use the forage utilization standards defined in agency guides; use levels should be consistent with objectives established by land use plans.

S1-G9. Guideline. Set forage utilization standards or stocking rates for livestock, wild horses and burros, and big game for riparian and upland areas based on species type, current allotment condition, and range management strategy.

S1-G10. Guideline. Design grazing systems to maintain or improve plant vigor.

S1-S25. Standard. Range project plans or allotment management plans and, where applicable, wild horse and burro herd management plans shall be developed, revised, and maintained. These plans establish objectives for managing vegetation resources (including activities needed to achieve the objectives) to achieve desirable riparian conditions (including improvement schedule if needed, grazing system, season of use, class of livestock, stocking levels, forage products and utilization rates, improvements needed to achieve objectives, and coordinating requirements).

S1-G11. Guideline. Intensive range management practices including rest

may be used to protect and improve riparian vegetation and fish and wildlife habitats.

S1-G12. Guideline. To stabilize soils, improve livestock forage conditions and wildlife habitat, seed poor condition rangelands to a site-specific mixture of native or desirable exotic grasses, forbs, and shrubs. Use seedings to decrease grazing pressure on native range to improve its condition.

S1-G13. Guideline. To stabilize soils after wildfire, seed rangelands that have a low potential for natural recovery with a site-specific mixture of native or desirable exotic grasses, forbs, and shrubs.

S1-G14. Guideline. Provide periods of rest from disturbance or livestock use during times of critical plant growth to maintain or improve vegetation condition.

S1-O22. Objective. On BLM-administered lands, follow the applicable standards for rangeland health and/or guidelines for livestock grazing management as described in Appendix 13 or succeeding direction.

Aquatic/Riparian/Hydrologic Component

Description and Management Intent

The following sections portray the current aquatic/riparian/hydrologic management direction within the project area. The general management direction section represents current management direction in approved land use plans. This is followed by the interim PACFISH/INFISH direction which amended land use plans. The third section represents reasonable and prudent measures, terms and conditions, and conservation recommendations found within Biological Opinions (NMFS 1995 and 1998, USFWS 1998) on affected land use plans for federally listed (under the Endangered Species Act) Snake River steelhead, sockeye, and spring/summer and fall chinook salmon, Upper Columbia River steelhead, bull trout, and Lost River and shortnose suckers. These Biological Opinion items supplement existing land use plan direction as amended by PACFISH/INFISH and apply to watersheds with listed aquatic species habitats, priority watersheds, or specific subbasins. Following the Biological Opinions section is Water Quality management direction.

Management Direction: General

S1-O23. Objective. Restore watersheds to reverse or arrest adverse impacts to water quality and fish habitat. Areas where fish habitat(s) or water quality have been adversely affected shall be given high priority for corrective treatments that mitigate impacts or rehabilitate these areas.

S1-O24. Objective. Provide and maintain a diverse, well-distributed pattern of fish habitat to increase anadromous and inland native fish runs. For example:

- Meet state water quality standards for stream temperature and streamside vegetation;
- Maintain sufficient large woody debris to provide for continuous long-term supply in all channels;
- Promote bank, floodplain, and channel stability to provide resiliency to disturbance and foster aquatic diversity; and
- Provide pools that are large, well distributed, and persistent during low flows, and conserve or restore channel morphology appropriate to the climate and landform.

S1-G15. Guideline. Practices that maintain or promote sufficient residual vegetation and appropriate channel morphology and functions can be used to maintain, improve, or restore riparian and wetland functions.

S1-O25. Objective. Achieve riparian and wetland area improvement and maintenance through management of existing uses, wherever feasible.

S1-O26. Objective. Limit or mitigate surface disturbance in floodplains, riparian areas, and aquatic habitats to prevent soil movement, loss, and sedimentation.

PACFISH and INFISH Direction

The following items apply to areas identified in decision notices and/or biological opinions for PACFISH, INFISH, and/or BLM statewide Interim

Bull Trout Habitat Conservation Strategies. See Appendix 9 for additional information.

Aquatic Habitat and Watershed Protection

S1-O27. Objective. Manage and provide aquatic habitat to contribute to the maintenance of stocks of anadromous and inland native fish and to ensure consistent, effective, and efficient Endangered Species Act consultation.

S1-O28. Objective. Provide protection for all watersheds containing designated critical habitat for listed anadromous fish (Key Watersheds).

S1-O29. Objective. Provide a pattern of protection across the landscape with an emphasis on federally listed fish. Include watersheds that have strong assemblages, degraded watersheds with a high restoration potential, and watersheds that provide for metapopulation objectives (Priority Watersheds).

S1-O30. Objective. Improve current conditions of watersheds by restoring degraded habitat and providing long-term protection to riparian and aquatic resources.

Riparian Habitat Conservation Areas (RHCAs)

Timber Management in RHCAs

S1-S26. Standard. Prohibit timber harvest, including fuelwood cutting, in Riparian Habitat Conservation Areas (RHCAs), except as described below. Do not include RHCAs in the land base used to determine the Allowable Sale Quantity; however, any volume harvested can contribute to the timber sale program.

a. Where catastrophic events such as fire, flooding, volcano, wind, or insects cause damage that results in degraded riparian conditions, allow salvage and fuel cutting in RHCAs only where present and future woody debris needs are met, where cutting would not retard or prevent attainment of other Riparian Management Objectives (RMOs), and where adverse effects can be avoided to aquatic resources. Ecosystem Analysis at the Watershed Scale shall be completed prior to harvest, including salvage and fuelwood cutting, in RHCAs.

b. Apply silvicultural practices for RHCAs to acquire desired vegetation characteristics where needed to attain RMOs. Apply silvicultural practices in a manner that does not retard attainment of RMOs and that avoids adverse effects on aquatic resources.

Roads in RHCAs

S1-S27. Standard. Cooperate with federal, tribal, state, and county agencies and cost-share partners to achieve consistency in road design, operation, and maintenance necessary to attain RMOs.

S1-S28. Standard. For each existing or planned road, meet the RMOs and avoid adverse effects on aquatic resources as described below:

a. Ecosystem Analysis at the Watershed Scale shall be completed prior to construction of new roads or landings in RHCAs.
b. Road and landing locations in RHCAs shall be minimized.
c. Initiate development and implementation of a Road Management Plan or a Transportation Management Plan. At a minimum, the plan shall address the following items:

- Road design criteria, elements, and standards that govern construction and reconstruction.
- Road management objectives for each road.
- Criteria that govern road operation, maintenance, and management.
- Requirements for pre-, during-, and post-storm inspections and maintenance.
- Regulation of traffic during wet periods to minimize erosion and sediment delivery and accomplish other objectives.
- Implementation and effectiveness of monitoring plans for road stability, drainage, and erosion control.
- Mitigation plans for road failures.

d. Avoid sediment delivery to streams from the road surface. Outsloping of the roadway surface is preferred, except in cases where outsloping would increase sediment delivery to streams or where outsloping is infeasible or unsafe. Route road drainage away from potentially

unstable stream channels, fills, and hillslopes.

e. Avoid disruption of natural hydrologic flow paths.

f. Avoid side casting of soils or snow. Side casting of road materials is prohibited on road segments within or abutting RHCAs.

S1-S29. Standard. Determine the influence of each road on RMOs. Meet RMOs and avoid adverse effects on aquatic resources by:

a. Reconstructing road and drainage features that do not meet design criteria or operation and maintenance standards, that have been shown to be less effective than designed for controlling sediment delivery, that retard attainment of RMOs, or that do not protect watersheds from increased sedimentation.

b. Prioritizing reconstruction based on the current and potential damage to aquatic resources and their watersheds, the ecological value of the riparian resources affected, and the feasibility of options such as helicopter logging and road relocation out of RHCAs.

c. Closing and stabilizing or obliterating and stabilizing roads not needed for future management activities. Prioritize these actions based on the current and potential damage to aquatic resources in watersheds and the ecological value of the riparian resources affected.

S1-S30. Standard. Improve existing culverts, bridges, and other stream crossings to accommodate a 100-year flood, including associated bedload and debris, where those existing structures would or do pose a substantial risk to riparian conditions. Such improvements should include those structures that do not meet design and operation maintenance criteria, that have been shown to be less effective than designed for controlling erosion, or that retard attainment of RMOs. Priority for upgrading shall be based on risks and the ecological value of the riparian resources affected. Construct and maintain crossings to prevent diversion of streamflow out of the channel and down the road in the event of crossing failures.

S1-S31. Standard. Provide and maintain fish passage at all crossings of existing and potential fish-bearing streams.

Livestock Grazing in RHCAs

S1-S32. Standard. Modify grazing practices (for example, accessibility of riparian areas to livestock, length of grazing season, stocking levels, timing of grazing) that retard or prevent attainment of RMOs or are likely to adversely affect aquatic resources. Suspend grazing if adjusting practices is not effective in meeting RMOs.

S1-S33. Standard. New livestock handling and/or management facilities shall be located outside of RHCAs. For existing livestock handling facilities inside RHCAs, assure that facilities do not prevent attainment of RMOs. Relocate or close facilities where these objectives cannot be met.

S1-S34. Standard. Limit livestock trailing, bedding, watering, loading, salting, and other handling efforts to those areas and times that would not retard attainment of RMOs or adversely affect aquatic resources.

S1-S35. Standard. Adjust wild horse and burro management to avoid impacts that prevent attainment of RMOs or adversely affect aquatic resources.

Mining in RHCAs

S1-S36. Standard. Avoid adverse impacts to listed species and designated critical habitat from mineral operations. If the Notice of Intent indicates that a mineral operation would be located in an RHCA and could affect attainment of RMOs or could adversely affect listed anadromous fish, then require a reclamation plan, approved Plan of Operations (or other such governing document), and reclamation bond. For effects that cannot be avoided, such plans and bonds must address the following items to attain RMOs and avoid adverse effects on listed anadromous fish: the costs of removing facilities, equipment, and materials; recontouring disturbed areas to approximate pre-mining topography; isolating and neutralizing or removing toxic or potentially toxic materials; salvage and replacement of topsoil; and seedbed preparation and revegetation. Ensure Reclamation Plans contain measurable attainment and bond release criteria for each reclamation activity.

S1-S37. Standard. Locate structures, support facilities, and roads outside RHCAs. Where no alternative to siting facilities in RHCAs exists, locate and construct the facilities in ways that avoid impacts to RHCAs and streams and that avoid adverse effects on aquatic resources. Where no alternative to road construction exists, keep roads to the minimum necessary for the approved mineral activity. Close, obliterate, and revegetate roads no longer required for mineral or land management activities.

S1-S38. Standard. Prohibit solid and sanitary waste facilities in RHCAs. If no alternative to locating mine waste (waste rock, spent ore, tailings) facilities in RHCAs exists, and if releases can be prevented and stability can be ensured, then:

a. Analyze the waste material using the best conventional sampling methods and analytic techniques to determine its chemical and physical stability characteristics.
b. Locate and design the waste facilities using the best conventional techniques to ensure mass stability and prevent the release of acid or toxic materials. If the best conventional technology is not sufficient to prevent such releases and ensure stability over the long term, prohibit such facilities in RHCAs.
c. Monitor waste and waste facilities to confirm predictions of chemical and physical stability, and make adjustments to operations as needed to avoid adverse effects to aquatic resources and to attain RMOs.
d. Reclaim and monitor waste facilities to assure chemical and physical stability and revegetation, to avoid adverse effects to aquatic resources, and to attain the RMOs.
e. Require reclamation bonds adequate to ensure long-term chemical and physical stability and successful revegetation of mine waste facilities.

S1-S39. Standard. For leasable minerals, prohibit surface occupancy within RHCAs for oil, gas, and geothermal exploration and development activities where contracts and leases do not already exist, unless there are no other options for location and RMOs can be attained and adverse effects to aquatic resources can be avoided. Adjust the operating plans of existing contracts to (1) eliminate impacts that prevent attainment of RMOs and (2) avoid adverse effects to native aquatic species.

S1-S40. Standard. Permit sand and gravel mining and extraction within RHCAs only if no alternatives exist, if the action(s) will not retard or prevent attainment of RMOs, and if adverse effects to native aquatic species can be avoided.

S1-S41. Standard. Develop inspection, monitoring, and reporting requirements for mineral activities. Evaluate and apply the results of inspection and monitoring to modify mineral plans, leases, or permits as needed to avoid adverse effects on native aquatic species and to eliminate impacts that prevent attainment of RMOs.

Fire Management in RHCAs

S1-S42. Standard. Design fuel treatment and fire suppression strategies, practices, and actions so as to not prevent attainment of RMOs and to minimize disturbances of riparian ground cover and vegetation. Strategies should recognize the role of fire in ecosystem function and identify those instances where fire suppression or fuel management actions could perpetuate or be damaging to long-term ecosystem function or aquatic resources.

S1-S43. Standard. Locate incident bases, camps, helibases, staging areas, helispots, and other centers for incident activities outside of RHCAs. If the only suitable location for such activities is within the RHCAs, an exemption may be granted following a review and recommendation by a resource advisor. The advisor would prescribe the location, use conditions, and rehabilitation requirements, with avoidance of adverse effects to aquatic resources a primary goal. Use an interdisciplinary team, including a fishery biologist, to predetermine incident base and helibase locations during pre-suppression planning.

S1-S44. Standard. Prohibit delivery of chemical retardant, foam, or additives to surface waters. An exception may be warranted in situations where overriding immediate safety imperatives exist, or, following a review and recommendation by a resource advisor and a fishery biologist, when the action agency determines an escaped fire would cause more long-term damage to fish habitats than chemical delivery to surface waters.

S1-S45. Standard. Prescribed burn projects and prescriptions should be designed to contribute to the attainment of the RMOs.

S1-S46. Standard. Immediately establish an emergency team to develop a rehabilitation treatment plan to attain RMOs and avoid adverse effects on aquatic resources whenever RHCAs are significantly damaged by a wildfire or a prescribed fire is burning out of prescription.

Hydro and Surface Water Projects in RHCAs

S1-S47. Standard. For hydroelectric and other surface water development proposals, require instream flows and habitat conditions that maintain or restore riparian resources, favorable channel conditions, and fish passage, reproduction, and growth. Coordinate this process with the appropriate state agencies. During relicensing of hydroelectric projects, provide to the Federal Energy Regulatory Commission (FERC) written and timely license conditions that require fish passage and flows and habitat conditions that maintain/restore riparian resources and channel integrity. Coordinate relicensing projects with the appropriate state agencies.

S1-S48. Standard. Locate new hydroelectric ancillary facilities outside RHCAs. For existing ancillary facilities inside the RHCA that are essential to proper management, provide recommendations to FERC to assure that the facilities would not prevent attainment of the RMOs and that adverse effects on aquatic resources are avoided. Where these objectives cannot be met, provide recommendations to FERC that such ancillary facilities should be relocated. Locate, operate, and maintain hydroelectric facilities that must be located in RHCAs to avoid adverse effects on aquatic resources.

Leases and Permits in RHCAs

S1-S49. Standard. Issue leases, permits, rights-of-way, and easements to avoid adverse effects on aquatic resources and to avoid effects that would be inconsistent with or prevent attainment of RMOs. Where the authority to do so was retained, adjust existing leases, permits, rights-of-way, and easements to eliminate effects that would retard or prevent attainment of the RMOs or adversely affect aquatic resources. If adjustments are not effective, eliminate the activity. Where the authority to adjust was not retained, negotiate to make changes in existing leases, permits, rights-of-way, and easements to eliminate effects that would prevent attainment of the RMOs or adversely affect aquatic resources. Priority for modifying existing leases, permits, rights-of-way, and easements would be based on the current and potential adverse effects on aquatic resources and the ecological value of the riparian resources affected.

Fuel, Pesticides, and Herbicides in RHCAs

S1-S50. Standard. Apply herbicides, pesticides, and other toxicants and chemicals in a manner that does not retard or prevent attainment of RMOs and that avoids adverse effects on aquatic resources.

S1-S51. Standard. Prohibit storage of fuels and other toxicants within RHCAs. Prohibit refueling within RHCAs unless there are no other alternatives. Refueling sites within RHCAs shall be approved by the Forest Service or Bureau of Land Management and have an approved spill containment plan.

S1-S52. Standard. Locate water drafting sites to avoid adverse effects on aquatic resources and instream flows, and in a manner that does not retard or prevent attainment of RMOs.

Watershed Restoration in RHCAs

S1-S53. Standard. Design and implement watershed restoration projects in a manner that promotes the long-term ecological integrity of ecosystems, conserves the genetic integrity of native species, and contributes to attainment of RMOs.

S1-S54. Standard. Design and implement fish and wildlife habitat restoration and enhancement actions in a manner that contributes to attainment of the RMOs.

S1-S55. Standard. Design, construct, and operate fish and wildlife interpretive and other user-enhancement facilities in a manner that does not retard or prevent attainment of RMOs or adversely affect aquatic resources. For existing fish and wildlife interpretive and other user-enhanced facilities inside RHCAs, assure that RMOs are met and adverse effects on aquatic resources are avoided. Where RMOs cannot be met or adverse

Definitions

Reasonable and prudent measures —Nondiscretionary measures that are necessary and appropriate to minimize the impact of incidental take of a species.

Terms and conditions — Set out the specific methods by which reasonable and prudent measures are to be accomplished.

Conservation recommendations [CR] — Discretionary measures to (1) minimize or avoid adverse effects of a proposed action on listed species or critical habitat, (2) conduct studies and develop information, and (3) promote the recovery of listed species.

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effects on aquatic resources avoided, relocate or close such facilities.

Recreation in RHCAs

S1-S56. Standard. Design, construct, and operate recreation facilities (including trails) and dispersed sites in a manner that does not retard or prevent attainment of RMOs and avoids effects on aquatic resources.

S1-S57. Standard. Complete Ecosystem Analysis at the Watershed Scale prior to construction of new recreation facilities in RHCAs.

S1-S58. Standard. For existing recreation facilities inside RHCAs, assure that facilities or use of facilities will not prevent attainment of RMOs or adversely affect native aquatic species. Relocate or close recreation facilities where RMOs cannot be met or adverse effects on aquatic resources cannot be avoided.

S1-S59. Standard. Adjust dispersed and developed recreation practices that retard or prevent attainment of RMOs or adversely affect aquatic resources. Where adjustment measures such as education, use limitations, traffic control devices, increased maintenance, relocation of facilities, and/or specific site closures are not effective in meeting RMOs and avoiding adverse effects on aquatic resources, eliminate the practice or occupancy.

Biological Opinions

Items in this section include Endangered Species Act requirements as expressed through the Biological Opinions on the Land and Resource Management Plans (LRMPs) as amended by PACFISH and INFISH (National Marine Fisheries Service [NMFS] 1995, NMFS 1998, U.S. Fish and Wildlife Service [USFWS] 1998). Topics that relate to the direction being proposed in this EIS were selected for presentation in this section. Where topics overlapped among the three Biological Opinions, they were paraphrased and combined. These combinations are identified in the following sections. Biological Opinion items are numbered here for reference purposes, without categorization as objectives or standards and with no correspondence to a numbering scheme from the Biological Opinions, although page numbers from the appropriate Biological Opinion are included. The Biological Opinions in their entirety would apply as appropriate under Alternative S1; the summary provided here is for general information only, to enable comparison among the alternatives.

The Opinions include reasonable and prudent measures, implementing terms and conditions, and conservation recommendations. Reasonable and prudent measures and terms and conditions are either (1) to emphasize and further clarify additional commitments for implementing LRMPs as amended by PACFISH and INFISH aquatic conservation strategies, or (2) become mandatory when and where found appropriate through consultation and/or prescribed by USFWS or NMFS in a site-specific biological opinion. Conservation recommendations are suggestions from the USFWS or NMFS regarding discretionary measures to (1) minimize or avoid adverse effects of a proposed action on listed species

or critical habitat, (2) conduct studies and develop information, and (3) promote the recovery of listed species. The categories of 'reasonable and prudent' and 'terms and conditions' generally are intermingled in the Opinions, so they are not distinguished by category in this section. Where conservation recommendations were identified in the Biological Opinions, they are marked as such here by [CR] following the listing.

Biological Opinion items apply either to watersheds with listed aquatic species habitats, Priority Watersheds, or specific subbasins. The following subsections correspond to these three areas.

Biological Opinions: All Watersheds with Habitat for Federally Listed Fish

The following items derived from the Biological Opinions (NMFS 1995, NMFS 1998, USFWS 1998) apply to both Priority and non-Priority Watersheds. **They apply only to those areas that have federally listed anadromous fish, bull trout, or suckers.** See the Biological Opinions for further details.

Implementation and Monitoring

S1-BO1. Provide a process, including designation of an implementation team, that ensures accountability and full implementation of programmatic aquatic conservation measures at all organizational levels. *[NMFS 98, page 83*] Include a mechanism for improved monitoring accountability and oversight of management actions that affect listed fish or their habitats, designed to meet the applicable objectives, standards, and guidelines of PACFISH and INFISH.*[USFWS, p.94]*

S1-BO2. Use the Level 1 team consultation process and apply the NMFS and USFWS matrices of pathways and indicators (see Appendix 9) or a similar approach as agreed to by the agencies. Evaluate actions to determine the potential effects on listed fish and to assure interagency coordination. *[USFWS, p.94 and p.96]*

S1-BO3. The results of Ecosystem Analysis at the Watershed Scale and other relevant information shall be applied to conclude whether actions either "meet" or "do not prevent attainment" of the aquatic conservation strategy objectives. The conclusion must be documented and supporting rationale provided. *[USFWS p.96]*

S1-BO4. The Forest Service regional/BLM state levels and the national forest/BLM district levels shall review annually the fiscal year program of work for attainment of fish conservation measures. The Forest Service, BLM, U.S. Fish and Wildlife Service, and National Marine Fisheries Service will mutually agree on the priority of these actions, identify significant shortfalls in funding or staffing, and identify potential adjustment(s) in management activities. They will also mutually develop and implement a strategy when funding or priorities prevent full implementation of the aquatic conservation measures. *[NMFS 98, p83]*

S1-BO5. Through interagency coordination, develop stratified aquatic monitoring plans by subbasin to evaluate impacts of management actions on listed fish. *[USFWS, p.96 and NMFS 98, p.84]* These plans should address at a minimum both compliance and effectiveness monitoring. Use an interagency group to maximize the utility of monitoring information through a coordinated effort and a defensible sampling design. The interagency groups should establish objectives for the monitoring plans in accordance with PACFISH and INFISH. Goals for the monitoring plans should include maximizing the effectiveness of limited monitoring funds, identifying appropriate scales and levels of monitoring necessary to determine if management actions are meeting PACFISH and INFISH direction, allowing for flexibility as funding and activities change, and identifying how monitoring results should be used to make management adjustments. *[USFWS, p.97]*

S1-BO6. Fully implement the monitoring plans by ensuring monitoring schedules are developed and implemented, with agreement among the Forest Service, BLM, National Marine Fisheries Service, and U.S. Fish and Wildlife Service. *[USFWS, p.97 and NMFS 98, p.83]* If these mutually agreed-upon schedules cannot be followed, an alternative approach will be developed and agreed to by the interagency group. Implement monitoring commensurate with the level of on-the-ground activities, and provide the U.S. Fish and Wildlife Service and the National Marine Fisheries Service feedback on the effects of activities.

S1-BO7. Through interagency coordination, develop stratified grazing monitoring plans. Stratification should be based on grazing intensity and potential for adverse effects on listed fish and designated critical habitat. Develop these plans by subbasin to maximize the utility of monitoring information through a coordinated effort and a defensible sampling design. These plans will be developed by an interagency group, which should establish objectives for the monitoring plans. Goals for the plans should include maximizing the effectiveness of limited monitoring funds, identifying appropriate scales and levels of monitoring necessary to determine if allotments are meeting PACFISH direction, allowing for flexibility as funding and activities change and identifying how monitoring results should be used to make management adjustments. *[NMFS 98, p.84]*

S1-BO8. Grazing monitoring schedules will be developed and implemented for ongoing as well as new range management activities. If monitoring schedules cannot be followed, an alternative monitoring approach will be developed and be subject to approval by the interagency teams. If an alternative monitoring approach is not agreed to in a timely fashion, the matter will be elevated for executive resolution. Until interagency agreement is reached on the alternate monitoring plan, grazing would be permitted only if it has been determined by the appropriate Level 1 team to be not likely to adversely affect listed species or designated critical habitat. *[NMFS 98, p.85]*

Road Evaluation and Planning

S1-BO9. Develop and implement guidance for use by administrative units for minimizing or reducing effects of road management activities on listed fish. *[USFWS, p.94 and p.97]* Issues that should be addressed in this guidance document include, but are not limited to, road construction, reconstruction, removal, obliteration, and decommissioning, as well as an assessment of unroaded and low density roaded areas in relation to conservation of listed fish. The exact scope, format, and detail of this guidance document should be decided through interagency discussions. Include the following in completing this task:

- Assessment of road construction and management, including unroaded and low density roaded areas in relation to conservation of listed fish (unroaded and low density roaded areas include designated wilderness, RARE II areas, or other unroaded areas identified in land use plans, Outstanding Resource Waters, and information contained within the *Assessment of Ecosystem Components* for ICBEMP);
- Descriptions, locations, and maps of unroaded and low density roaded areas, and existing information on the relative habitat value of the areas for listed fish;
- Summary and review of existing management direction, and recommendations to senior agency managers regarding at a minimum: need for additional habitat protection, risks to listed fish from developmental activities, priority for subbasin assessments and watershed analyses, connectivity between areas, and restoration priorities;
- A mutually agreed upon strategy to accomplish any additional habitat protections recommended by the technical/ research team. *[USFWS, p.97 and NMFS, p.86-87]*

Proposed projects requiring road construction in any of these unroaded or low density roaded areas shall be considered to have insufficient analysis for the completion of Section 7 consultation and shall not be forwarded to Level 1 teams until this assessment has been completed. *[NMFS, p.87]*

S1-BO10. Using existing information and road definitions, provide the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS) with road inventories on the management units within the area covered by listed fish direction. This information should include a description of road definitions and survey methodology used. Missing information will be provided to NMFS and the USFWS within two years after signing of the Biological Opinion. *[NMFS 98, p.85]*

S1-BO11. Annually update the road inventories, including a reconnaissance protocol for identifying, recording, and prioritizing new problems as they arise. *[NMFS 98, p.85]*

Watershed and Habitat Restoration Analysis and Actions

S1-BO12. The Forest Service and BLM should work cooperatively with the National Marine Fisheries Service, the U.S. Fish and Wildlife Service, state agencies, and tribes to develop priorities and adequately fund restoration. *[NMFS 98, p.80]*

S1-BO13. In cooperation with the National Marine Fisheries Service and the U.S. Fish and Wildlife Service, develop multi-year strategies to accelerate restoration of habitat for listed fish. These multi-year/multi-scale restoration strategies shall: (1) be dynamic documents modified annually to reflect priorities and opportunities determined through watershed analyses; (2) include project-specific information (developed at watershed, subbasin, or basin scales); (3) incorporate road restoration information; (4) incorporate restoration opportunities resulting from the roadless assessment; and (5) serve as the source for implementing restoration projects. *[NMFS 98, p.88]*

S1-BO14. Emphasis should be increased on Ecosystem Analysis at the Watershed Scale and the development of a schedule for each unit to complete such analyses in a timely manner. *[NMFS 98, p.80]*

S1-BO15. The Forest Service and BLM shall submit to the National Marine Fisheries Service and the U.S. Fish and Wildlife Service a schedule for the completion of at least one Ecosystem Analysis at the Watershed Scale per management unit (national forest and BLM resource area) per year. The analyses shall follow the protocol in the *Federal Guide for Watershed Analysis* and any updates to that guide. *[NMFS 98, p.89]*

S1-BO16. Conduct subbasin assessments to provide context for habitat status and restoration priorities within subbasins and watersheds. [CR] *[USFWS, p.100]* In coordination with the National Marine Fisheries Service and the U.S. Fish and Wildlife Service, the Forest Service and BLM shall complete at least one subbasin assessment per management unit per year. These analyses will adhere to protocols and provide the products mutually agreed upon by the Forest Service, BLM, National Marine Fisheries Service, and U. S. Fish and Wildlife Service. Goals and objectives identified in subbasin analyses need to be incorporated into action plans at the watershed scale. *[NMFS 98, p. 90]*

S1-BO17. Apply the results of Ecosystem Analysis at the Watershed Scale where required or applicable, and consider expected benefits to listed fish during the design and prioritization of instream habitat enhancement and restoration projects, culvert replacement upgrades, and road decommissioning actions. Assess proposed watershed and habitat restoration actions to ensure that potential short-term adverse effects on listed fish are outweighed by long-term benefits. *[USFWS, p.95]*

S1-BO18. Ensure that the timing of any work within intermittent or perennial stream channels associated with these projects is designed to minimize or reduce short-term adverse effects on aquatic habitat and listed fish. *[USFWS, p.95]*

S1-BO19. Provide documentation of information and criteria used to design and prioritize actions to demonstrate that the timing of in-channel work associated with the subject projects will minimize short-term adverse effects on aquatic habitat, and to demonstrate compliance with applicable objectives, standards, and guidelines of the aquatic conservation strategy. *[USFWS, p.98]*

S1-BO20. To ensure that proposed actions are designed to provide for long-term habitat benefits while avoiding, minimizing, or reducing short-term impacts, use information and recommendations from completed Ecosystem Analysis at the Watershed Scale reports, the most current watershed scale environmental baseline, and the determination of effects of proposed actions using the NMFS/USFWS matrix and checklist (see Appendix 9), or an agreed upon approach. *[USFWS, p.98]*

S1-BO21. Seek to restore or improve connectivity within and between isolated sub-populations of listed fish, except in cases where the risks of non-native species introductions override the risks to continued population isolation. [CR] *[USFWS, p.100]*

S1-BO22. Use all information—including findings from Ecosystem Analysis at the Watershed Scale, and other pertinent information—to determine how Riparian Management Objectives, RHCAs, and standards and

guidelines should be modified to better address the needs of listed fish. [CR] *[USFWS, p100]*

S1-BO23. The Forest Service and BLM will provide leadership in developing partnerships with other federal agencies, with state agencies, tribes, and private entities to implement actions that will lead to the survival and recovery of listed fish populations. [CR] *[USFWS, p.101]*

Road Construction Actions

S1-BO24. Avoid, reduce, or minimize the adverse effects of road construction, reconstruction, and maintenance on listed fish habitat components, particularly water quality, flow and hydrology, and channel condition and dynamics. Avoid, reduce, or minimize incidental take associated with these adverse effects. *[USFWS, p.95 and p.98]*

S1-BO25. New roads (temporary, semi-permanent, or permanent) in RHCAs shall be minimized to the greatest extent possible, and shall be constructed only where watershed analyses have been completed to document that the roads would not prevent attainment of aquatic conservation strategy objectives. *[USFWS, p.98*]

S1-BO26. Watershed road densities of less than 1.0 mile per square mile, especially where there are bull trout stronghold populations, may be necessary to assure future survival and recovery to self-sustaining populations. [CR] *[USFWS, p.100]*

S1-BO27. Reduce passage problems for bull trout associated with culverts and water diversions. [CR] *[USFWS, p.100]*

S1-BO28. Screen all water intakes appropriately to prevent the entrainment of bull trout of all age classes. [CR] *[USFWS, p.100]*

Livestock Grazing Actions

S1-BO29. Review, modify, and implement annual operating instructions or term grazing permits to meet appropriate PACFISH or INFISH objectives for those allotments/leases that encompass streams known or expected to contain listed fish. *[USFWS, p.95]*

S1-BO30. When reviewing and modifying grazing actions to minimize or reduce incidental take, amend livestock grazing annual operating instructions, term grazing permits, or leases to incorporate appropriate criteria for evaluating ecological conditions of affected areas to ensure attainment of aquatic conservation strategy objectives. *[USFWS, p.98]* As allotment management plans are amended or revised, modify the AMPs to meet appropriate PACFISH or INFISH objectives. *[USFWS, p.95]*

S1-BO31. Develop and implement grazing management plans and practices in areas of known or suspected listed fish spawning to minimize or reduce trampling of redds and other direct and indirect effects that may result in take of the species. *[USFWS, p.95]* Some actions that may be considered include: numbers of animals, timing and duration of grazing, herding, fencing of riparian areas, or upland water sites.*[USFWS, p.99]*

Mining Actions

S1-BO32. Minimize/reduce the adverse effects of mining actions (including placer mining, recreational suction dredging, and gold panning) that result in take of the species by implementing all relevant PACFISH and INFISH standards and guidelines. *[USFWS, p.96]*

S1-BO33. For mining operations on BLM- or Forest Service-administered lands that are not required to have an approved Plan of Operation (see 43 CFR 3809.1-4 and 36 CFR 228.4), respond to all mining notices within 10 calendar days by advising the operator that the mining activity shall not cause take of listed fish unless the operator has first obtained an incidental take permit under Section 10 of the Endangered Species Act. The BLM or Forest Service will advise the operator of the actions needed to prevent adverse impacts on listed fish and their habitat. *[USFWS, p.98]*

S1-BO34. For mining operations where the administrative unit has discretion to require a Plan of Operations, require such a plan if the mining operation has the potential to adversely affect listed fish. *[USFWS, p.99]* Work with the Environmental Protection Agency and the state water quality agency to ensure that draft plans of operation for new mines that have the potential to produce acid rock drainage (either in the ore body, pregnant ore storage area, waste

rock storage area, or mine tailings storage area) are conditioned so that the mines will not adversely affect groundwater or surface water quality in a manner that would adversely affect fish habitat or retard or prevent attainment and maintenance of ecological goals and Riparian Management Objectives.*[NMFS 95, p.84]* Ensure that the plan complies with applicable minerals management standards and guidelines for the aquatic conservation strategy. *[USFWS, p.99]*

S1-BO35. To protect listed fish habitat, determine whether future development of mining claims, mineral leasing, or sale of mineral materials would adversely affect habitat conditions in currently and historically occupied watersheds necessary for recovery, and use all available administrative authority, including withdrawals, to minimize such impacts. [CR] *[USFWS, p.101]*

S1-BO36. For areas where mining effects on listed fish habitat cannot adequately be mitigated, withdraw these areas from location of new mining claims and prohibit mineral leasing and sales of mineral materials. For existing mining claims and mineral leases in these areas, use all available administrative authority to minimize and mitigate the adverse effects of mining on listed fish. [CR] *[USFWS, p.101]*

Timber Management Actions

S1-BO37. Analyze, design, and implement timber harvest activities to meet the requirements of PACFISH and INFISH and such additional measures as needed to minimize or reduce incidental take of listed fish, through incorporation of the following terms and conditions:

1. Evaluate effects on listed fish and develop mitigation measures by using: (a) the indicators for listed fish habitat needs contained in the U.S. Fish and Wildlife Service/NMFS matrices or a similar evaluation tool agreed upon by the agencies and (b) information from the scientific literature, models (validated with local data wherever possible), and on-site studies to evaluate slope stability and landslide hazard and risk; and
2. Develop and implement approaches that address and minimize potential incidental take of listed fish from fuel storage and transportation associated with timber harvest actions. *[USFWS, p.99]*
3. Address impacts from the action on water quality, habitat access, habitat elements, channel condition and dynamics, stream flow, hydrology, and watershed conditions. *[USFWS, p.96]*

Other Management Actions and Land Uses

S1-BO38. The Forest Service and the BLM shall exercise their existing authorities on land management programs with a pattern of adverse effects on listed fish. *[NMFS 98, p.87]*

S1-BO39. Access—including for livestock, off-road vehicles, anglers, and other uses—should be eliminated or adequately restricted during spawning and incubation periods. *[NMFS 95, p.83]*

S1-BO40. Risk of toxic fuel spills should be minimized during transport through RHCAs by using alternative routes where feasible and by taking all other possible precautions. *[NMFS 95, p.83]*

S1-BO41. Assure that water conveyance intakes with the potential to trap or impinge listed fish would meet established intake screening criteria before use is approved. Assure that permits would be authorized or reauthorized only if streamflows are adequate to not retard or prevent attainment of Riparian Management Objectives and would not adversely affected listed salmon. *[NMFS 95, p.84]*

S1-BO42. Following a fire that affected RHCAs in watersheds with designated critical habitat, suppression and rehabilitation efforts should be reviewed to determine whether the requirements and tactics identified in the Fire Situation Analysis or Wildland Fire Situation Analysis were successfully implemented and if the revegetation and rehabilitation of the burned area were successful. *[NMFS 95, p.85]*

S1-BO43. Review effects on steelhead from commercial permits and non-commercial recreational boating and floating for adverse effects on steelhead spawning. Where adverse impacts are reducing steelhead productivity, commercial permits

and non-commercial recreational boating and floating should be modified to reduce or eliminate the adverse effects. *[NMFS 98, p.80]*

Biological Opinions: Priority Watersheds

The National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS) issued Biological Opinions (NMFS 1995 and 1998, USFWS 1998) on Forest Service and BLM land use plans as amended by the PACFISH and/or INFISH interim strategies. These Biological Opinions require the Forest Service and BLM to identify Priority or Key Watersheds for federally listed salmon, steelhead, bull trout, and Lost River and shortnose suckers within the project area. Habitat and population criteria contained within the Biological Opinions were used to identify Priority Watersheds. The following items have been paraphrased and summarized from the Biological Opinions, which should be consulted for exact language and additional details. These items pertain only to identified Priority or Key Watersheds.

Physical and Ecological Conditions

S1-BO44. In Priority Watersheds, minimize the risk of degradation to existing physical and ecological conditions, and maximize the probability of maintaining good habitat conditions. Land management actions within these watersheds should demonstrate a high probability that high quality habitats will be maintained, expanded, and reconnected. *[NMFS 95, p.74 and p.78]*

RMOs for Priority Watersheds

In addition to PACFISH/INFISH Riparian Management Objectives (RMOs; see Appendix 9), the Biological Opinions require the following modifications or additions to PACFISH/INFISH RMOs:

S1-BO45. In Priority Watersheds, limit stream surface fine sediment (less than 6.4 millimeters in diameter) or fine sediment by depth to less than 20 percent in spawning habitat. Adjust land management practices to reduce fine sediment delivery, increase residual pool volumes, and reduce fine sediment volumes where fine sediment is higher than natural. *[NMFS 95, p.75]*

S1-BO46. In Priority Watersheds, limit cobble embeddedness to less than 30 percent in rearing habitat. *[NMFS 95, p.75]*

S1-BO47. In Priority Watersheds, width-to-depth ratio shall be less than or equal to 10 or consistent with the range for the channel type. *[NMFS 95, p.75]*

S1-BO48. In Priority Watersheds, at least 90 percent of all stream banks should be in stable condition. *[NMFS 95, p.76]*

Mining Actions

S1-BO49. In Priority Watersheds, the full extent of authorities should be used to ensure that new mines (including hard-rock, placer, sand and gravel, and other mining operations [ore body, waste rock, spent ore, tailings, roads, milling, chemical storage, housing, etc.]) are located outside of RHCAs. There may be some exceptions for activities with a *de minimis* risk of adverse effects. *[NMFS 95, p.78]*

Rationale: Examples of activities that may pose more than a *de minimis* risk include: (1) new roads, (2) actions with impacts greater than three acres, and (3) actions that cause modifications that cannot be restored within one year.

S1-BO50. In Priority Watersheds, watershed analysis should be completed prior to approving plans of operation for new mineral activities outside RHCAs that are likely to adversely affect listed fish, designated critical habitat, or ecological processes and functions. Based on watershed analysis results, proposed plans of operation should be adjusted to prevent degradation of the ecological processes and functions and adverse effects on listed fish and designated critical habitat. *[NMFS 95, p.78]*

Timber Management Actions

S1-BO51. In Priority Watersheds, if any salvage or silvicultural activities are proposed within RHCAs that pose more than a *de minimis* risk of adverse effects on listed salmon or critical habitat, it must be demonstrated clearly, based on both Ecosystem Analysis at the Watershed Scale and site-specific analyses, how these actions will avoid adverse effects on listed fish and their habitat and how the activities will not retard or prevent attainment and maintenance of ecological goals and Riparian Management Objectives. *[NMFS 95, p.79]*

Rationale: Examples of actions that pose more than a *de minimis* risk in RHCAs include: (a) machinery-related ground disturbance; (b) cutting of live fire-resistant tree species such as ponderosa pine, Douglas-fir, western larch, or lodgepole pine; (c) cutting of any native species of trees or shrubs that are contributing shade to the stream; and (d) cutting or removal of any large trees from RHCAs that could contribute to maintaining or restoring a natural regime of large woody debris recruitment.

S1-BO52. For new/proposed timber sales in Priority Watersheds, equivalent clearcut areas (ECAs) should be evaluated. If the area exceeds 15 percent of the potentially forested area, Ecosystem Analysis at the Watershed Scale should be conducted prior to initiating actions that would increase ECA. Actions that would increase ECA should proceed after Ecosystem Analysis at the Watershed Scale only if there is low to *de minimis* risk of adversely affecting fish habitat and if attainment and maintenance of ecological goals and Riparian Management Objectives will not be retarded or prevented. *[NMFS 95, p.80]*

S1-BO53. For new/proposed timber management actions in Priority Watersheds, Ecosystem Analysis at the Watershed Scale should be conducted prior to reducing RHCA widths. *[NMFS 95, p.80]*

Roads

S1-BO54. Collaborate with the National Marine Fisheries Service (and the U.S. Fish and Wildlife Service if available) in developing multi-year road restoration strategies for Priority Watersheds. [*USFWS, p.94 and NMFS 98 p.85]* Restoration strategies will identify key processes needing attention, prioritize key locations and project types, address implementation and scheduling issues, and provide preliminary cost estimates. Subbasin assessments and watershed analyses will be the primary process for integrating and interpreting amended road information, inventories, and other potential information. *[NMFS 98, p.85]*

S1-BO55. For proposed/new roads in Priority Watersheds where road density is greater than two miles per square mile, road mileage should be reduced and road closure, obliteration, and revegetation should be emphasized. *[NMFS 95, p.81]*

S1-BO56. For ongoing road development actions in Priority Watersheds, it should be demonstrated that new roads are being offset by concomitant reductions in road mileage and road restoration. *[NMFS 95, p.81]*

S1-BO57. Reduce total road densities and prevent any increase in road densities in all priority watersheds containing bull trout. [CR] *[USFWS, p.100]*

Roadless Areas

S1-BO58. In Priority Watersheds, the functions and values of roadless areas for maintaining and restoring ecological conditions should be carefully evaluated prior to proposing new actions in these areas. Collectively, the actions must pose no more than a *de minimis* risk of degrading these functions and values. *[NMFS 95, p.82]*

Watershed Restoration

S1-BO59. Restoration activities should initially be focused in Priority Watersheds selected as such because of their restoration potential. *[NMFS 95, p.82]*

S1-BO60. In Priority Watersheds, watershed restoration strategies should be developed for Priority Watersheds within the context of broader area plans (subbasin, Forest, etc.) where possible. *[NMFS 95, p.83]*

S1-BO61. In Priority Watersheds, emphasis should be on implementing multi-agency restoration plans in readily restorable habitat. *[NMFS 95, p.83]*

S1-BO62. In Priority Watersheds, direct restoration of RHCAs or stream channels, including but not limited to additions of large woody debris, should be undertaken only concurrent with a corresponding change to the management regime responsible for the habitat degradation. *[NMFS 95, p.83]*

S1-BO63. In Priority Watersheds, priority should be given to watershed restoration actions that will help improve degraded stream reaches adjacent to or connected to remaining reaches of high quality habitat. *[NMFS 95, p.83]*

Biological Opinions: Selway River, Middle Fork Salmon River, and South Fork SalmonRiver Subbasins

The following items apply only to the Selway River, Middle Fork Salmon River, and South Fork Salmon River Subbasins. See the Biological Opinions for further details.

S1-BO64. Maintain and restore the unique ecological features and genetic characteristics of steelhead within the Selway, Middle Fork Salmon, and South Fork Salmon rivers. *[NMFS 98, p.78]*

S1-BO65. In the Selway River, Middle Fork Salmon River, and South Fork Salmon River subbasins, develop a schedule and prioritize to close, obliterate and revegetate, or resurface as many existing roads as possible. Existing roads in RHCAs should receive high priority for treatment. If resurfaced, cover the existing native surface open roads with aggregate or pavement to control erosion and sedimentation; stabilize cut-and-fill slopes. *[NMFS 98, p.78]*

S1-BO66. In the Selway River, Middle Fork Salmon River, and South Fork Salmon River subbasins, build new roads only to replace existing roads in RHCAs or to directly repair human-caused damage to steelhead habitat streams. *[NMFS 98, p.78]*

S1-BO67. In the Selway River, Middle Fork Salmon River, and South Fork Salmon River subbasins, do not widen roads by increasing cut-and-fill slope areas in order to accommodate more traffic and/or larger vehicles than can presently use the road.*[NMFS 98, p.79]*

S1-BO68. In the Selway River, Middle Fork Salmon River, and South Fork Salmon River subbasins, do not open closed and revegetated roads for management purposes unless necessary to repair human-caused damage to steelhead habitat.*[NMFS 98, p.79]*

S1-BO69. In the Selway River, Middle Fork Salmon River, and South Fork Salmon River subbasins, methods described by Prellwitz (1994) and Hall et al. (1994) should be used to define landslide prone areas, or an equivalent peer reviewed methodology with at least a 90 percent probability of identifying landslide prone slopes should be used. *[NMFS 98, p.79]*

S1-BO70. In the Selway River, Middle Fork Salmon River, and South Fork Salmon River subbasins, emphasize containment and confinement rather than control strategies to manage wildfire.*[NMFS 98, p.79]*

S1-BO71. In the Selway River, Middle Fork Salmon River, and South Fork Salmon River subbasins, use tractors for fire management only in the immediate vicinity of private property or to protect life, as in the construction of safety zones. *[NMFS 98, p.79]*

S1-BO72. In the Selway River, Middle Fork Salmon River, and South Fork Salmon River subbasins, maximize the use of planned ignitions and natural prescribed fire to meet vegetation management objectives. *[NMFS 98, p.79]*

S1-BO73. In the Selway River, Middle Fork Salmon River, and South Fork Salmon River subbasins, use draft water from sources where the intake is screened or where no salmon or steelhead are present.*[NMFS 98, p.79]*

S1-BO74. In the Selway River, Middle Fork Salmon River, and South Fork Salmon River subbasins, use only those timber harvest methods (such as helicopters and horses) that result in low levels of ground disturbance or that avoid adverse effects on steelhead. *[NMFS 98, p.79]*

S1-BO75. In the Selway River, Middle Fork Salmon River, and South Fork Salmon River subbasins, use only existing open roads for timber management, without construction of new landings.*[NMFS 98, p.79]*

S1-BO76. In the Selway River, Middle Fork Salmon River, and South Fork Salmon River subbasins, do not harvest timber in RHCAs.*[NMFS 98, p.79]*

S1-BO77. In the Selway River, Middle Fork Salmon River, and South Fork Salmon River subbasins, manage for natural bank stability of streams using best available data. *[NMFS 98, p.79]*

S1-BO78. In the Selway River, Middle Fork Salmon River, and South Fork Salmon River subbasins, locate holding facilities for domestic livestock outside of RHCAs. *[NMFS 98, p.79]*

S1-BO79. In the Selway River, Middle Fork Salmon River, and South Fork Salmon River subbasins, allow motorized use only on open roads and trails designed for such purposes. *[NMFS 98, p.80]*

S1-BO80. In the Selway River, Middle Fork Salmon River, and South Fork Salmon River subbasins, where steelhead spawning has been documented and where disturbance of spawning fish is likely to occur, close streams or affected reaches to commercial and non-commercial recreational boating and floating in any craft from April to June of each year. *[NMFS 98, p.80]*

[end of Biological Opinion section]

Water Quality and Hydrologic Processes

S1-S60. Standard. Meet or exceed state water quality protection and restoration and federal Endangered Species Act requirements through planning, application, and monitoring of Best Management Practices (BMPs).

S1-S61. Standard. Beneficial uses shall be protected by implementing water quality practices, plans, and policies in current memoranda of understanding with the states.

S1-S62. Standard. Proposed projects or management actions shall be evaluated for cumulative effects on water quality, water quantity, and stream channels.

S1-G16. Guideline. Consider dispersing activities in time and space, where practicable, to the extent needed to meet management requirements.

S1-S63. Standard. Where Outstanding Resource Waters are designated by a state or tribe, existing water quality shall be maintained.

Rationale: This standard requires the Forest Service and BLM to continue to comply with existing state law. Few waters are currently designated as Outstanding Resource Waters. One water body in Oregon is proposed for designation and none in Washington are currently designated as such. No water in Idaho is currently designated as such, although two water bodies have been recommended to the legislature for legal designation. Under Oregon Administrative Rules, the Department of Environmental Quality developed draft guidance for Outstanding Resource Waters. This guidance states that waters nominated for designation by the Environmental Quality Commission would receive interim protection until they are legally designated and management plans are developed. Water bodies that are designated would be managed for no degradation of existing water quality. No special management is required for proposed water bodies. In Idaho, under Title 39, Chapter 36 of the Health and Safety code, once a water is officially designated as an Outstanding Resource Water, existing activities may continue and shall restore and maintain the current water quality; new or existing nonpoint source activities can be conducted only if they do not lower water quality. An exception would be for short-term or temporary actions that do not alter the character of the water.

S1-S64. Standard. Where waters exceed applicable water quality standards, state or tribal anti-degradation requirements shall be met.

S1-S65. Standard. Within watersheds with Water Quality Limited Segments (as defined by Section 303(d) of the Clean Water Act), management activities shall be implemented in compliance with state-developed, or, when applicable, EPA-developed total maximum daily loads (TMDLs), with the intent to restore water quality to meet state or tribal water quality standards. Provide an early opportunity for intergovernmental collaboration in the development of TMDLs.

Terrestrial and Aquatic Species

Viability and Harvestability

S1-O31. Objective. Provide habitat for viable populations of existing native and desirable non-native vertebrate wildlife species.

S1-S66. Standard. Old/mature tree habitat (reserve where appropriate or develop replacement habitat where presently unavailable) should be maintained and well distributed across the landscape for indicator species that are

dependent on old forests. Meet key species requirements by managing (reserve) areas of appropriate size and arrangement with adequate larger, older trees; proper stand structures and densities (usually multi-storied); snags and downed logs; associated feeding habitat; and other criteria.

S1-S67. Standard. Adequate dead trees (snags) should be left to provide the required numbers and size of snags throughout the forest to maintain primary cavity excavators at 40 to 60 percent of their potential population in timber production areas and at appropriate levels in other areas; leave appropriate levels of green trees to serve as a source of future snags.

S1-S68. Standard. Dead and downed logs should be provided in appropriate numbers by size classes to support species that use this resource.

S1-S69. Standard. Forest stands and shrub and grassland communities and successional stages should be managed to provide suitable big game habitat(s) cover quality, cover size and spacing, open road densities, and forage quality to meet species needs as defined in a Habitat Effectiveness Index.

S1-S70. Standard. Big game habitats, including winter ranges, calving/fawning areas, wallows, and migration areas, should be protected at key times by maintaining desired vegetation structure and characteristics.

S1-S71. Standard. Unique or featured wildlife habitats, including cliffs, talus, caves, seeps-springs, bogs, wallows and other wet areas (generally under 10 acres), should be managed to protect their primary values.

Aquatic and Terrestrial Threatened, Endangered, Proposed Species (TEP)

S1-O32. Objective. Contribute to the recovery of federally listed or proposed species (or subspecies or populations) across their range by restoring and maintaining habitat quality, quantity, and effectiveness.

Rationale: Section 7 of the 1973 Endangered Species Act, as amended, requires the Forest Service and BLM to manage consistent with and in consultation with listing agencies. Rangewide recovery requires a higher level of management (for example, collaboration and cooperation among federal, tribal, state, and local agencies) than strictly being in compliance with recovery plans. The Forest Service and BLM recognize special status species and have management strategies in place to prevent further listings.

S1-S72. Standard. Habitats shall be managed to recover special status species and prevent the listing of these species as candidate, threatened, or endangered.

Rationale: BLM Manual 6840 and Forest Service Manual 2600.

S1-S73. Standard. When implementing recovery plans for raptor species, subspecies, and populations that are significantly recovering within the project area, apply standards and guidelines from finalized agency documents that have been contributing to recovery.

Rationale: The bald eagle and peregrine falcon are near recovery goals identified in recovery plans. Agencies should continue efforts that been contributing to recovery until species are delisted.

S1-S74. Standard. Management activities shall be consistent with uniform planning and management procedures by adopting the resource management guidelines and grizzly bear management situations as established in the Interagency Grizzly Bear Committee (IGBC) Management Guidelines (1986), or its successor.

Rationale: Guidelines need to be uniformly applied for consistency of anticipated effects.

S1-S75. Standard. Management activities shall be consistent with access management recommendations developed by the Interagency Grizzly Bear Committee (IGBC) Managers Subcommittee for the Cabinet/Yaak and Selkirk Mountains Grizzly Bear Recovery Zones, following NEPA procedures at appropriate scales.

Rationale: Access provided by roads increases the vulnerability of grizzly bears to mortality. Proposals for development and use of roads need to be evaluated in this context.

S1-S76. **Standard.** For federal threatened, endangered, candidate, or special status species, use required biological assessment/evaluation procedures and meet consultation requirements. Promote preservation, restoration and/or maintenance of their habitats.

Social-Economic-Tribal Component

S1-O33. **Objective.** Coordinate management of lands, resources, and activities administered by the BLM or Forest Service with local, state, and federal agencies; private landowners; American Indian tribes; and interest and user groups.

S1-G17. **Guideline.** Developing and strengthening partnerships can be emphasized while managing and enhancing resource use (fish, wildlife, recreation, others).

S1-G18. **Guideline.** Coordinate fire management activities in rural interface areas with local governments, agencies, and landowners.

S1-O34. **Objective.** Foster public awareness of, involvement in, and support for national forest and BLM district land management objectives and programs.

S1-O35. **Objective.** Support strategies that enhance rural community economic advancement; define complementary roles and implement programs that best serve the public. Assist in providing developmental, tourism, and recreational activities that help diversify rural economies and improve quality of life that attracts in-migration related to amenities.

S1-S77. **Standard.** Provide a predictable supply of timber and other forest products within sustainable limits of the ecosystem(s).

S1-S78. **Standard.** Provide a predictable supply of forage for livestock and wild horses within sustainable limits of the ecosystem.

S1-O36. **Objective.** Provide for ceded land rights and treaty privileges of American Indians.

S1-O37. **Objective.** Consult and coordinate planning and management activities with the tribes.

Alternatives S2 and S3

Key Features That are the Same as the Draft EIS Alternatives 3–7

Five goals were developed for the action alternatives in the Eastside and UCRB Draft EISs. These goals have been carried forward, unchanged, to the Supplemental Draft EIS. The ICBEMP goals are broad, general statements of intent that were derived from the Purpose and Need statement, issues identified through the initial scoping processes, and the Project Charter. All of the alternatives address these goals to some extent and in varying amounts of time. The extent to which each goal is met by an alternatives is part of the analysis of consequences discussed in Chapter 4. The results of the analysis will help in selecting an alternative for the ROD.

Goals

Goal 1: Sustain, and where necessary, restore the health of forest, rangeland, aquatic, and riparian ecosystems.
Goal 2: Provide a predictable, sustained flow of economic benefits within the capability of the ecosystem.
Goal 3: Provide diverse recreational and educational opportunities within the capability of the ecosystem.
Goal 4: Contribute to recovery and delisting of threatened and endangered species.
Goal 5: Manage natural resources consistent with treaty and trust responsibilities to American Indian tribes.

Key Features that Differ from Draft EIS Alternatives 3–7

The ICBEMP Supplemental Draft EIS attempts to improve clarity, focus, and implementability of the proposed management direction using the feedback received on the Draft EISs as a guide. The revised alternatives:

- Integrate landscape dynamics, terrestrial, aquatic, and socio-economic-tribal components into one ecosystem management strategy;
- Protect important aquatic and terrestrial habitats;
- Identify priority areas for restoration; and
- Provide a better link to existing management direction and step-down processes, combining some land designations with increased managerial flexibility on the local level.

The following key features distinguish Alternatives S2 and S3 from Alternatives 3 through 7 in the Draft EISs:

1. **Focus** - Narrowed focus, limited to issues for which there is a compelling and critical need to direct resource management at the basin scale. Examples of such critical and compelling issues include but are not limited to: long-term viability for wide-ranging fish and wildlife species, water quality, rapid spread of noxious weeds, uncharacteristic wildfire, and social and economic needs.
2. **Geographic/spatial elements** - Specific important habitats with intact succession/disturbance regimes are identified and mapped, including: aquatic core habitat network (aquatic [A1, A2] subwatersheds) and terrestrial source habitats (terrestrial [T] watersheds). Areas are also identified as having a broad-scale high priority for restoration.
3. **Hierarchy of direction** - Management direction is hierarchical in that some types of direction take precedence over others (see the following section). The hierarchy helps to clarify which direction would apply should two management designations overlap with each other.
4. **Restoration strategy** - Broad-scale restoration direction is provided. Some of this broad-scale direction is functional in nature (relates primarily to aquatic or terrestrial habitats, for example); however, most of the broad-scale direction integrates ecological needs and opportunities with social and economic (including tribal) needs and opportunities. See the section on Hierarchy of Direction, below, for additional information.
5. **Risk management** - More emphasis is placed on managing various types and levels of risk to resources. The ICBEMP integrated ecosystem management strategies could also be called risk management strategies. The location, timing, and intensity of management actions can vary depending on what level of risk is acceptable at the local level. Determining acceptable levels of risk entails considering risks from conducting management actions and from taking no management actions, short-term risks and long-term risks, and fine-scale risks in the context of larger-scale processes and conditions. All these aspects of risk, along with potential benefits, must be considered before the trade-offs are fully understood.
6. **Implementation plan**
   - *step-down process* showing what analysis is needed (mid-scale analysis [Subbasin Review], Ecosystem Analysis at the Watershed Scale [EAWS], or site-specific NEPA analysis) and links among decision levels;
   - a *monitoring process* linked to step-down (see Appendix 10);
   - increased focus on interagency and intergovernmental *collaboration*;
   - a *budget strategy* showing funding assumptions.

Hierarchy of Management Direction

Management direction is either base level (applies to all Forest Service- and BLM-administered lands in the project area), restoration (applies wherever restoration occurs), or geographically specific (applies only to certain mapped areas; in this EIS, these areas are aquatic A1 and A2 subwatersheds and terrestrial T watersheds). These different types of direction are intended to be consistent. When there are conflicts, the most restrictive direction prevails.

Base Level Direction

The intent of base level direction is to *maintain* ecosystems and resources that are in good condition, and prevent further deterioration of ecosystems and resources that are not in good condition until they can be actively or passively restored. Base level direction

would amend or augment management direction in existing land use plans, although the specific location, timing, and intensity of management actions required to achieve the broad-scale ICBEMP direction still would be determined by local Forest Service and BLM managers. Acceptable levels of short-term and long-term risk from conducting management actions and from conducting no management actions must be considered when making these finer-scale decisions.

Restoration Direction

The intent of restoration direction is to *improve* resource conditions that are not functioning properly by focusing restoration activities in the most efficient and effective manner possible. Restoration activities are intended to address and benefit multiple ecosystem components, including the needs of communities and American Indian tribes. Restoration direction applies wherever restoration activities occur, such as in subbasins identified as high restoration priority and in areas with locally identified restoration priorities.

Subbasins with functional (one resource, such as aquatics) and integrated (many resources) priorities have been identified and mapped as having a high restoration priority from a broad-scale perspective. This was done to assist national forests and BLM districts in prioritizing local restoration activities and to assist in their budget planning processes.

Certain subbasins were identified as high restoration priority because they have high risk to fish and wildlife and their habitats from natural disturbances, there is good opportunity to reduce those risks through restoration activities, and some of the restoration actions would provide employment and economic opportunities for isolated and economically specialized communities and tribal communities. *In Alternative S2*, 40 high restoration priority subbasins were identified. Thirteen of the 40 subbasins were included because of the opportunities to expand and improve extent, condition, and connectivity of aquatic habitat. *In Alternative S3,* 51 high restoration priority subbasins were identified. Eleven subbasins were added to the 40 subbasins in Alternative S2 because of they would add additional employment and economic opportunities for communities, including tribal communities.

Geographically Specific Areas

Several areas (called aquatic A1 and A2 subwatersheds and terrestrial T watersheds) were identified and mapped because of their importance for fish and wildlife and their habitats. The management intent of these geographically specific areas is to secure, or protect, the habitats from adverse effects in the short term from management activities, and to build upon, or restore, the habitats in the long term, in part by decreasing the likelihood of uncommon natural disturbance (such as from unusually severe wildfire). Management direction for these mapped areas is generally more restrictive than base level or restoration direction, and would take precedence if there were a conflict in direction. Management direction for riparian conservation areas and threatened, endangered, or proposed species also falls into this category.

Management descriptions, intent, and direction that is specific to Alternative S2 only or to Alternative S3 only is indented and/or italicized. Management descriptions, intent, and direction that apply to both Alternatives S2 and S3 is not indented or italicized.

Management Direction—Step-Down, Adaptive Management, and Monitoring

Step-down

Description and Management Intent – Step-down

Step-down is the process of applying broad-scale science findings and land use decisions to site-specific areas using a hierarchical approach of understanding current resource conditions, risks, and opportunities. Information developed through analysis at different scales provides additional context that is beneficial in understanding how projects can be developed that meet multiple management objectives, including reducing risks to sensitive or unique resources.

Analysis of ecosystems is a systematic way of gathering, organizing, and understanding information within a selected geographic area. It is not a decision-making process, but it does provide the information and context to make well informed decisions. With this information, managers can better understand and disclose the effects of their decisions. It is useful in guiding the type, location, and sequencing of appropriate management activities within a watershed, as well as in helping identify inventory and monitoring needs. Information gained from this hierarchical analysis approach may also be used in future amendments and revisions of land use plans.

Hierarchical step-down analysis (programmatic planning, Subbasin Review, EAWS, and site-specific NEPA analysis) provides information necessary to ensure that site-specific decisions will implement broad-scale, outcome-based direction, while giving managers the discretion necessary to select the action that also fits the situation on the ground.

Four levels of analysis below the basin-level analysis conducted by the ICBEMP are intended to provide the context to appropriately implement these broad-level decisions on individual national forests and BLM districts. They include:

- Subregional analysis (programmatic, or broad overview, EIS; for example, BLM resource management plans or Forest Service land and resource management plans);
- Mid-scale analysis (Subbasin Review);
- Watershed-scale analysis (Ecosystem Analysis at the Watershed Scale);
- Site-specific NEPA analysis (environmental analysis or environmental impact statement).

It is intended that these analyses be conducted in certain circumstances to reduce the overall risks to resources, while maximizing the opportunities to conserve and restore resource conditions. In essence, the step-down process is a risk management approach, which addresses risks at different scales. The ICBEMP EIS addresses broad-scale or regional risks, whereas the various step-down analysis processes address finer-scale risks. Subregional risks are addressed through land use plans, mid-scale or landscape risks through Subbasin Review and/or EAWS, and site-specific risks through site-specific NEPA analysis. Under this approach, regional, subregional and landscape analyses and decisions provide context for the remaining risks to be addressed at the site level. Through a multi-level analysis and decision process, all levels of risk would

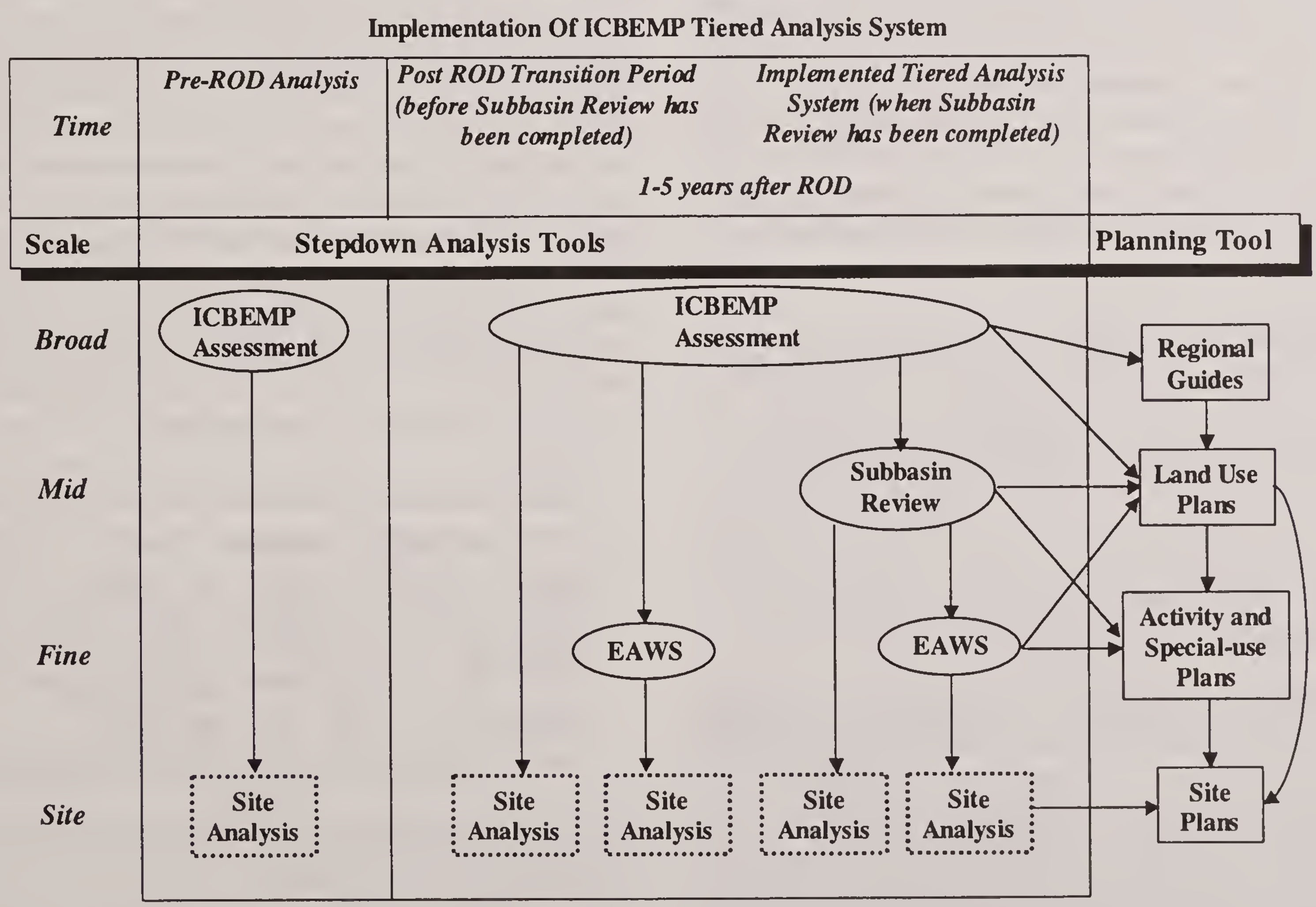


Figure 3-1. Step-down.

be addressed, with management activities focused on risks at the site level where the most detailed analyses are conducted. The hierarchical analysis process will be phased in over five years. Figure 3-1 illustrates how analysis will be done during the phase-in period.

Since site-specific NEPA analysis and programmatic planning analyses have been widely used since the inception of NEPA in 1969, FLPMA in 1976, and NFMA in 1976, further elaboration of these analysis requirements or techniques is not included in the following step-down discussion. However, a few components of site-specific analyses that are particularly important to an ecosystem management strategy warrant some discussion. Mid-scale and watershed-scale analyses can provide valuable context, focus, and information for site-specific NEPA analysis.

Documenting the proposed and alternative actions and the analysis of their impacts, including cumulative impacts, is particularly important. Documentation of the context provided by mid- and fine-scale analyses that are relevant to site-specific analysis and decisions is also important. That context includes information which facilitates management of risk to resources from natural events and management actions at different scales (geographic and temporal). Subbasin Review and EAWS enhance the understanding of risk and opportunities and provide a hierarchically scaled context and information base of support for site-specific analysis and decisions. Decisions regarding where and when to take short-term risks, particularly where listed or proposed species are present, need to be made to the extent possible within the context of information generated through the step-down process, with clear documentation of analysis and rationale.

Alternative S2 Only. In Alternative S2, one of the main emphases is to minimize short-term risk, especially to threatened, endangered, or proposed species, important species habitats, and riparian areas. Therefore, the intent is to put a greater emphasis on conducting analyses, such as Subbasin Review and Ecosystem Analysis at the Watershed Scale (EAWS), prior to conducting management activities.

Alternative S3 Only. In Alternative S3, there is more of an emphasis to address long-term risk to resources from uncharacteristically severe disturbances more rapidly than Alternatives S1 or S2. This would occur by allowing more activities to occur prior to conducting analyses, such as Subbasin Review and Ecosystem Analysis at the Watershed Scale (EAWS). These landscape treatments would be planned and designed during appropriately scaled analysis as part of or preceding the required NEPA analysis. Important habitats are still protected or maintained.

Collaboration is also important during step-down processes. By conducting mid- and fine-scale analyses in a collaborative environment, management opportunities and priorities can be agreed on earlier in the process, which leads to decisions that have more support at finer scales. At the same time, collaboration can be a challenge. The Forest Service and BLM must initiate collaboration to demonstrate a good faith effort during step-down. However, the step-down processes cannot stop if all the appropriate parties cannot come to agreement on certain elements of a decision or if one or more partners cannot or do not remain involved throughout the process.

Description and Management Intent — Mid-scale

The *Assessment of Ecosystem Components in the Interior Columbia Basin* found that the mid scale is an important scale for addressing management of ecosystem components, because many important relationships and patterns are evident only at the mid scale. The following direction to complete Subbasin Review as an initial step in implementing broad-scale decisions through site-specific actions is intended to provide this mid-scale understanding of relationships and patterns within the subbasin (4th-field HUC, approximately 800,000—1,000,000 acres) or groups of subbasins. By conducting Subbasin Review, decision makers can better balance the short- and long-term risks to resources and provide more predictable and sustainable levels of goods and services for people and communities. Information from Subbasin Review is used to identify opportunities and priorities, focus finer scaled analyses, and provide context for future decision-making at the land use planning and project levels.

By conducting Subbasin Review, decision makers can better balance the short- and long-term risks to resources and provide more predictable and sustainable levels of goods and services for people and communities.

Specifically, Subbasin Review is intended to be conducted collaboratively to:

- Review information provided in the *Assessment of Ecosystem Components, Integrated Scientific Assessment,* and other applicable science information, and existing local information;

- Identify data gaps;
- Identify local resource issues, and describe how they interact with each other and with broad-scale issues within the subbasin;
- Identify the need for Ecosystem Analysis at the Watershed Scale (EAWS), roads analysis, and other analyses within the subbasin(s);
- Prioritize/schedule EAWS and other analyses that are needed within the subbasin(s);
- Provide mid-scale context for finer-scale analyses and activities, including EAWS and roads analysis;
- Identify opportunities for land use plan amendment or revision to meet broad-scale and more localized objectives;
- Identify and prioritize risks and opportunities to meet broad-scale and more localized objectives through site-specific management actions;
- Assess risks and opportunities to reduce potential unwanted effects from management actions and land uses (for example, road-related adverse effects) and to better balance short- and long-term, and mid- and fine-scale risks;
- Establish context for assessment of effects on environmental justice (Executive Order 12898) and civil rights at mid- or fine-scale decision-making levels;
- Characterize landscape elements that contribute to or influence hazards and risks associated with roads;
- Identify opportunities for pooling interagency (federal agencies) and intergovernmental (tribes, states, counties, cities) resources for prioritizing and completing EAWS and other analyses;
- Consider state, county, tribal, or other agency restoration priorities;
- Invite tribal participation to identify and characterize resources and places of value, solicit data and other information, and solicit tribally identified priorities and restoration opportunities. Use this information along with the broad-scale tribal restoration priority subbasins map (see Map 3-7 later in this chapter) to assist in prioritizing local restoration activities;
- Identify and map important areas and dispersal corridors for wide-ranging carnivores;
- Identify areas, priorities, and opportunities for restoration to create a larger or more contiguous network of connected, productive aquatic/riparian and/or terrestrial habitats. Use broad-scale aquatic/riparian restoration priorities (see Map 3-3 later in this chapter), broad-scale old forest/rangeland habitat restoration priorities subbasins (see Map 3-5 later in this chapter), A2 subwatershed restoration priorities, location of A1 and A2 subwatersheds, and location of source habitats that have declined substantially in geographic extent from historical to current periods in T watersheds.

Because of the variability of conditions within the interior Columbia Basin, the broad-scale ICBEMP direction is outcome based rather than prescriptive. Ecosystems are characterized at different scales, as appropriate, through hierarchical analysis (programmatic planning, Subbasin Review, EAWS, and site-specific NEPA analysis). This provides information necessary to ensure that site-specific decisions implement broad-scale, outcome-based direction, while giving managers the discretion necessary to select the action that also fits the situation on the ground. Measurable indicators will be used, where appropriate, to provide context and decision support to determine the appropriateness of management activities with respect to the broad-scale objectives.

Landscape characterization includes historical as well as current conditions of the land; therefore, it should also include people who have used the area historically and their relationship to the land and resources, as well as people who currently use the land. Understanding of how and where people historically lived and worked in an area can be improved by knowing the types of uses that existed in a given area through time. For example, historical mining areas, old railroad beds, ceded lands, Civilian Conservation Corps structures, or the presence of a nearby Japanese internment camp might be indicative of a particular minority or ethnic group that used and related to the land in a particular way. These uses/features might provide the impetus to seek out representatives of these groups to better describe their relationship with the land/resources from historical to current times as a part of characterization. This information can then be used to address subsequent NEPA analysis and decision-making requirements.

Subbasin Review is intended to be a dynamic process whereby risks, opportunities, and priorities are revisited when issues or conditions change. Information can be added to respond to additional issues as they arise, or as information is developed through other avenues.

To assist in understanding the intended outcome of Subbasin Review, as well as to help field offices carry out their responsibilities to conduct these reviews, a draft guidebook has been prepared to guide Subbasin Review. This guidebook describes a process that has been tested and would meet the purpose of Subbasin Review as described above. It includes a series of

questions relative to the key resources addressed by the ICBEMP, including aquatic, terrestrial, landscape dynamics, and socio-economic resources, that are intended to help focus the review. While these questions have been determined to be appropriate for a Subbasin Review, they can be answered in different ways, depending upon the resources at issue and the type of existing data available to address the issue. Administrative units are encouraged to use creative thinking in addressing these questions, identifying opportunities, and developing priorities.

Objectives, Standards, and Guidelines — Subbasin Review

B-O1. Objective. Use mid-scale information on the status, risk, and opportunities within a subbasin as context for finer scale analysis and to identify and prioritize types of management activities appropriate to meet broad-scale objectives. Use a collaborative approach and broad- and mid-scale information to identify and help balance short- and long-term risks to resources, to identify opportunities to conserve and restore resource conditions, and to produce goods and services for people and communities within the subbasin.

Rationale: Status is defined here as the condition of the resources relative to the historical condition. *Risk* includes both short- and long-term risks of adversely affecting the current condition of these resources. *Opportunities* are situations where improvements in resource condition or a reduction in risk can be achieved through some form of subsequent management decision. These decisions will be made either through adjustments in land use plans or through project decisions, both of which include additional analysis and public involvement. In certain cases, Ecosystem Analysis at the Watershed Scale will be needed or required prior to developing site-specific proposals. This analysis is intended to provide additional information to decision makers so they can better balance the short- and long-term risks to resources.

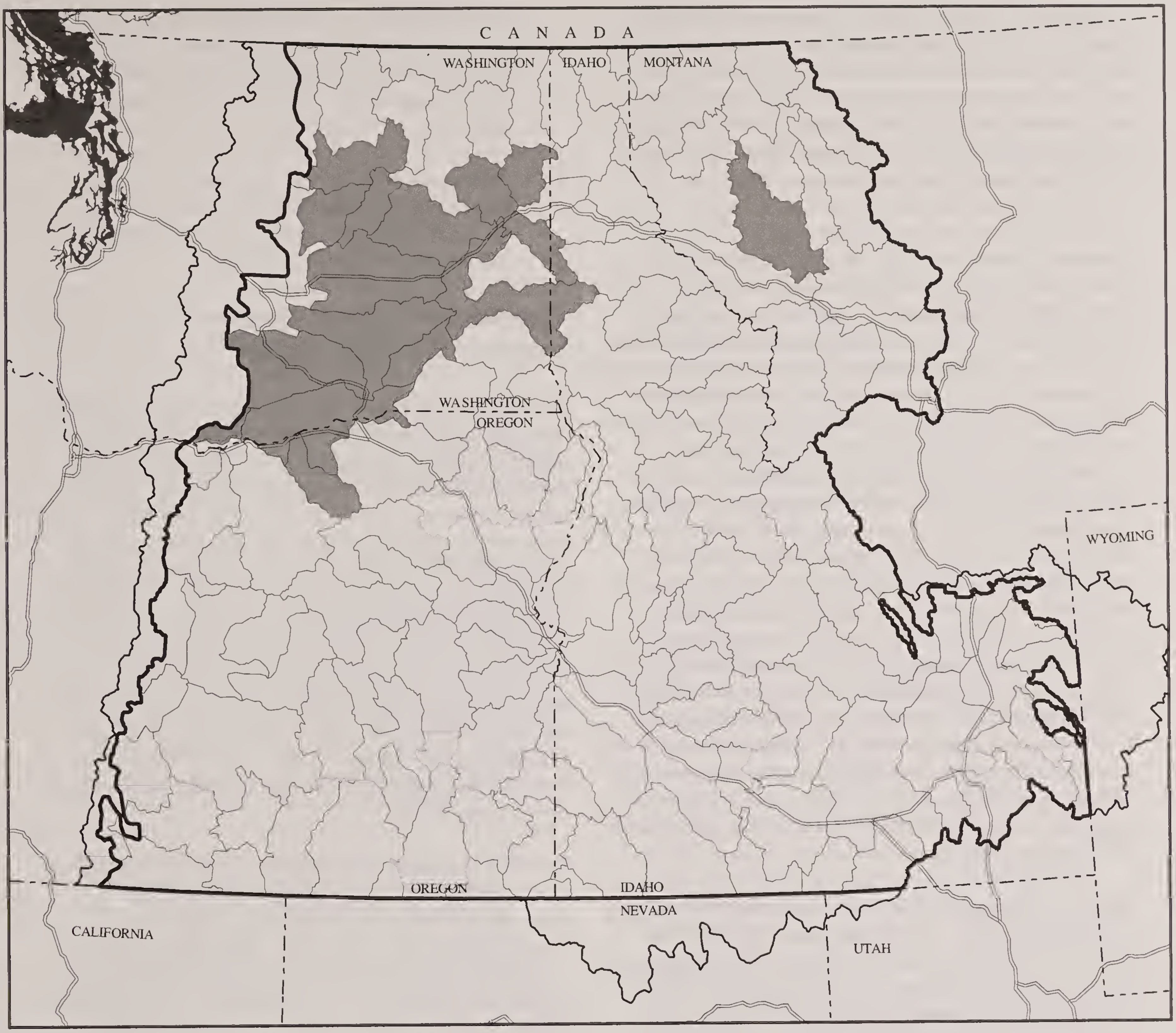
B-S1(S2). Standard ***for Alternative S2 Only.*** Subbasin Review shall be conducted to provide the mid-scale context outlined in B-O1 and as described in the Subbasin Review Guide (in development). Subbasin Review shall be used to: (a) prioritize and provide context for EAWS and other analyses; (b) within high restoration priority subbasins, identify the schedule for completing EAWS that are needed in the subbasin; (c) identify opportunities for future activities and land use plan amendments/revisions; (d) understand the potential for effects from possible activities; (e) identify data gaps; and (f) identify opportunities to pool resources.

Rationale: While the context provided by Subbasin Review will help decision makers balance short- and long-term risks to resources within the subbasin, it is not the intent of B-S1(S2) to prohibit resource management activities from occurring prior to its completion. Rather, as subbasin reviews are complete, information from these analyses will be used to provide context for other analyses and for future land use plan and project decisions. In Alternative S2 several conditions trigger EAWS (see Standard B-S5[S2]). Subbasin Review can be used to identify priorities and schedules for conducting additional EAWS if they are determined to be appropriate and have not already been triggered.

B-S1(S3). Standard ***for Alternative S3 Only.*** Subbasin Review shall be conducted to provide the mid-scale context outlined in B-O1 and as described in the Subbasin Review Guide (in development). Subbasin Review shall be used to: (a) prioritize and provide context for EAWS and other analyses; (b) identify the schedule for completing EAWS that are needed in the subbasin; (c) identify opportunities for future activities and land use plan amendments/revisions; (d) understand the potential for effects from possible activities; (e) identify data gaps; and (f) identify opportunities to pool resources.

Rationale: While the context provided by Subbasin Review will help decision makers balance short- and long-term risks to resources within the subbasin, it is not the intent of B-S1(S3) to prohibit resource management activities from occurring prior to its completion. Rather, as Subbasin Reviews are complete, information from these analyses will be used to provide context for other analyses and for future land use plan and project decisions. In Alternative S3 there are no "triggers" for EAWS; therefore, Subbasin Review will serve to identify priorities and schedules for conducting necessary EAWS.

B-S2. Standard. Subbasins with less than five percent BLM/Forest Service ownership (Map 3-1) or areas where the collaborating partners agree the intent of Subbasin Review has been met through other analytical processes are exempt from B-S1(S2) and B-S1(S3) requiring Subbasin Review. BLM and Forest Service administrative units shall initiate collaboration with National Marine Fisheries Service, U. S. Fish



Map 3-1.
Subbasins with Less Than 5% BLM- and Forest Service-Administered Lands

50 0 50 100 150 miles

50 0 50 100 150 km

N

Subbasins with Less Than 5% BLM- and FS-Administered Lands

Subbasin Borders

Major Roads

Supplemental Draft EIS Area Border

INTERIOR COLUMBIA BASIN ECOSYSTEM MANAGEMENT PROJECT

Supplemental Draft EIS Area
2000

and Wildlife Service, and EPA to discuss the general condition of BLM and Forest Service resources within the subbasin, the role these lands play within the subbasin, and the potential to reduce risks or provide opportunities to meet broad-scale objectives for the subbasin. The need to conduct additional mid-scale or finer scale analyses and the potential to pool resources shall also be discussed.

Rationale: Mid-scale analysis, landscape analysis, or Ecosystem Analysis at the Watershed Scale has already been conducted in many places within the project area. Where the collaborating partners agree that the intent of Subbasin Review (including identifying resource conditions and risks, prioritizing management opportunities, and addressing issues such as connectivity and interrelationships within the subbasin) has been met through previous analysis, efforts should focus primarily on gaining a broader understanding of the conditions, risks, and opportunities. Collaboration can increase awareness and understanding among the partners concerning what analysis has been completed, the results of these analyses, and a mid-scale view of the resources, issues, and opportunities within the subbasin. In this case, reanalyzing the information may not be necessary to accomplish the intent of Subbasin Review. Collaboration can enhance interagency awareness and understanding; however, if all collaborating partners cannot or do not participate, the land management agencies (BLM and Forest Service) will continue with the step-down process.

B-S3. Standard. Conduct Subbasin Review using a subbasin (4th-field HUC, approximately 800,000—1,000,000 acres) or groups of contiguous subbasins as the analysis unit, except where alternative analysis units have been agreed to collaboratively.

B-S4(S2). Standard ***for Alternative S2 Only.*** Subbasin Reviews shall be completed for subbasins identified as high priority for restoration (see Map 3-8 later in this chapter) within two years following the signing of the ICBEMP Record of Decision. All other Subbasin Reviews or requirements described in B-S1(S2) shall be completed within five years of the signing of the ICBEMP Record of Decision.

Rationale: See the Description and Management Intent for Restoration direction for a discussion of broad-scale integrated priority subbasins. Conducting Subbasin Reviews in these areas first ensures that the mid-scale level of analysis occurs first where it is anticipated that the most activity will occur.

B-S4(S3). Standard ***for Alternative S3 Only.*** Subbasin Reviews or requirements described in B-S1(S3) shall be completed within five years following the signing of the ICBEMP Record of Decision.

Rationale: While there will still be a lot of activity in subbasins prioritized for restoration, Alternative S3 provides greater flexibility for the scheduling of Subbasin Review.

Description and Management Intent — Watershed-scale

Ecosystem Analysis at the Watershed Scale (EAWS) is an analytical process that characterizes the human, aquatic, riparian, terrestrial, and other special features, conditions, processes and interactions that occur within a watershed (*Ecosystem Analysis at the Watershed Scale, Federal Guide for Watershed Analysis,* revised August 1995, version 2.2, Portland, Oregon [*Federal Guide for Watershed Analysis*]). It is an issue-driven process that provides information concerning resource conditions, risks, and opportunities in a systematic way, thereby enhancing agencies' ability to estimate direct, indirect, and cumulative effects of management actions. EAWS follows the six-step process outlined in the *Federal Guide for Watershed Analysis.* Collaboration is to be initiated by the Forest Service and BLM.

EAWS is intended to be used as a tool for identifying management actions needed to meet overall management objectives, and at the same time provides information useful in managing the mix of short- and long-term risks to resources that occur within the watershed. It is intended to be conducted where it adds value by contributing information needed for planning, locating, and designing activities across a watershed.

Alternative S2 Only. *While standard B-S5(S2), described below, will "trigger" the need to conduct EAWS prior to initiating project planning and implementation in some areas, it is intended that Subbasin Review (described in standard B-S1[S2]), and EAWS be used to identify actions that would best meet the management objectives within a watershed. In this way, actions are proposed within the context provided by the mid- and watershed-scale analyses, and managers will have a better opportunity to balance the needs of resources and humans and be less likely to negatively impact threatened, endangered, or proposed aquatic species or species at risk.*

Alternative S3 Only. *It is intended that Subbasin Review (described in standard B-S1[S3]) and EAWS be used to identify actions that would best meet the management objectives within a watershed. In this way, actions are proposed within the context provided by the mid- and watershed-scale analyses, and managers will have a better opportunity to balance the needs of resources and humans with potential effects on resources.*

Information gathered through EAWS is valuable for identifying riparian conservation area (RCA) criteria as described in B-S35(S2) and B-S35(S3); however, other programmatic planning processes also may be used to identify RCA criteria. Information from these analyses, where completed, will provide the contextual information to revise the interim RCA criteria (see the RCA Delineation and Management Direction sections, later in this chapter).

Alternative S2 Only. *While recognizing that EAWS is useful in locating and designing management activities, it is not reasonable or appropriate to assume that all activities are "on hold" until EAWS is completed. In an effort to balance the amount of analytical process requirements with the intent to actively and quickly restore resource conditions, the EAWS "triggers" described in standard B-S5(S2) are designed to generate a more detailed understanding provided by EAWS. These are areas where the greatest risk to threatened, endangered, and proposed aquatic species from management activities exists. EAWS will also be used to reduce risks to those terrestrial species with source habitats that have declined substantially in geographic extent from historical to current periods, as defined in objective T-O1, and to reduce risks in high restoration priority subbasins.*

Standard B-S5(S2) for Alternative S2 only requires EAWS to be done where there is potential to negatively impact certain species or their habitats, unless those impacts are anticipated to be negligible, short term, and localized in extent. Some assert that this can only be determined after EAWS or site-specific NEPA is conducted. However, the intent is that EAWS will precede NEPA analysis; in fact, it will be the analytical process used to identify the need for the project or activity. The intent is to ensure managers do their best to use EAWS as a tool to help in subsequent planning, design, and implementation of projects. As a general rule, managers have the knowledge and experience to judge the type of activities that are likely to have negligible, short-term, and localized effects. The intent is to make this determination in an interdisciplinary, collaborative setting prior to conducting EAWS.

One of Subbasin Review's primary purposes is to provide a setting for such a determination (see standard B-S1). When conducting Subbasin Review, land managers will be able to identify areas where they believe there is a need to conduct management activities that have the potential to negatively impact threatened, endangered, or proposed aquatic species or their habitats. It is not intended that management activities have zero effect on these species' habitats, but rather that the degree of impact be viewed in terms of the likelihood of a measurable change in the quantity or quality of the habitat.

For example, there may be a situation in Alternative S2 where Subbasin Review identifies that terrestrial source habitats in a T watershed are at risk from wildfire due to changes in understory structure. A prescribed fire in the cool, moist, spring would likely reduce the risk from wildfire, which would probably occur in the hottest, driest part of the year. In turn, fire effects would be less severe in the spring, reducing the chance that it would adversely affect the source habitat in the T watershed. However, although the management activity would be designed to protect a source habitat from wildfire, there is a potential for the source habitat to be negatively affected by the activity. Therefore, EAWS would be required prior to designing the management activity. In this example, the land manager would not need to know the precise prescription before determining whether EAWS was required. This determination would likely be collaborative.

In other cases, where the potential to negatively impact listed species or source habitat is less obvious, and where consensus cannot be reached among the collaborating partners, the line officer will make the determination, document the rationale for the determination, and notify the partners of the decision. Where a dispute arises concerning this determination, the dispute resolution process which will be included in the Record of Decision is intended to be used.

It is not the intent of this requirement in Alternative S2 to limit on-going actions. On-going activities will be evaluated during the conference/consultation process when new species or populations are listed under the Endangered Species Act.

Alternative S3 Only. *While recognizing that EAWS is useful in locating and designing manage-*

ment activities, it is not reasonable or appropriate to assume that all activities are "on hold" until EAWS is completed. Subbasin Review is the process that would be used to identify the priority and schedule for completing EAWS that are needed in the subbasin. The context provided by Subbasin Review will help decision makers balance short- and long-term risks to resources, such as listed or proposed species, within the subbasin.

New and ongoing activities will be evaluated during the appropriate step-down processes (programmatic planning, Subbasin Review, EAWS, and/or site-specific NEPA analysis) for potential effects on resources; and during the conference/consultation process when new species or populations are listed under the Endangered Species Act.

Objectives, Standards, and Guidelines — Ecosystem Analysis at the Watershed Scale (EAWS)

B-O2. Objective. Use watershed-scale information to address resource conditions, risks, and opportunities; to provide context and focus for site-specific NEPA analysis, decision-making, implementation, and monitoring; and to enhance the agencies' ability to estimate direct, indirect, and cumulative effects.

Rationale: EAWS is an issue-driven process that is a valuable tool in understanding the conditions and risks to resources. It is intended to help balance short- and long-term risks through the proper placement and timing of management actions within a watershed. While the intent of this objective is to use watershed-scale information to manage risks associated with threatened, endangered, and proposed species and those species with habitat that has declined substantially in geographic extent from historical to current periods, the expectation is that Ecosystem Analysis at the Watershed Scale will be used to meet the broad-scale objectives in this EIS.

B-S5(S2). Standard for Alternative S2 Only (no parallel standard for Altenative S3). Ecosystem Analysis at the Watershed Scale shall be conducted prior to planning and designing resource management activities where there is potential for those activities to negatively impact threatened, endangered, or proposed aquatic species or their habitats, or the source habitats within T watersheds that have declined substantially in geographic extent from the historical to current period. The only exception is where impacts are anticipated to be negligible, short term, and localized in scope.

In subbasins identified as high priority for restoration (see standard B-S4[S2]), the location and timing of watersheds or sub-watersheds requiring EAWS shall be determined through Subbasin Review, and shall be prioritized by level of risk to aquatic and terrestrial species habitat (watersheds with the highest risk would require EAWS first).

Rationale for Alternative S2: *Resource management activities,* as used in this standard, refer to those actions that require the preparation of an environmental assessment (EA) or EIS under the National Environmental Policy Act of 1969, such as timber sales and road construction. The magnitude or intensity of an EAWS is intended to be appropriate to the anticipated issues. It is an issue-focused not activity-focused process, and therefore can be done without being "triggered" by an activity. Potential to negatively impact is defined here to include potential for measurable long-term, direct or indirect management-related change, of an individual or cumulative nature, in the quantity or quality of the habitats referred to above. The intent is to ensure the location and design of activities are improved with the information generated through EAWS; therefore, EAWS are conducted where they add value by improving planning, design, and implementation of projects and activities.

Rationale for Alternative S3: Alternative S3 allows more short-term risk from management activities than Alternative S2; therefore there are no "triggers" for EAWS; (that is, EAWS is not required by a certain situation or in a certain location prior to conducting management activities). In the absence of standard B-S5, Subbasin Review will serve to identify priorities and schedules for conducting necessary EAWS. In addition, new and ongoing actions will be evaluated during the appropriate step-down processes for potential effects on resources, and during the conference/consultation process when new species or populations are listed under the Endangered Species Act.

B-S6. Standard. The latest versions of the *Ecosystem Analysis at the Watershed Scale, Federal Guide for Watershed Analysis* and the Forest Service/BLM policy implementation guides shall be used when conducting Ecosystem Analysis.

B-S7(S2). Standard *for Alternative S2 Only (no parallel standard for Alternative S3).*

Exemptions from standard B-S5(S2) requirements may be granted following review and approval by the ICBEMP Executive Steering Committee or their designated representatives. Requests for exemption shall be submitted in writing and include detailed rationale.

Rationale: Some resource management activities, while having only limited, site-specific impacts, may trigger the requirement to prepare an EA or EIS because of their controversial nature. Decisions concerning these actions would not likely gain substantial benefit from the information provided by Ecosystem Analysis at the Watershed Scale. The intent of this standard is to develop and use a process to screen these types of activities and exempt them from EAWS requirements where determined appropriate.

Adaptive Management

Description and Management Intent

Adaptive management is a procedure in which decisions are made as part of an on-going process. It involves planning, implementing, monitoring, evaluating, and incorporating new knowledge into management approaches (see Figure 3-2). This process builds on current knowledge, observation, experimentation, and learning from experience, which are then used to modify management methods and policies. This definition of adaptive management used in this EIS is not the same definition as is sometimes used within scientific literature.

Adaptive management is useful for two primary purposes:

1. Adjust management because:
   a. planned direction is adapted to a site-specific situation which is different than what was assumed during planning (for example, high road density for an area was assumed in the EIS but low road density was found on the ground);
   b. an event (for example flood or wildfire) changes the characteristics of the environment;
   c. new information accumulates over time through monitoring that indicates planned objectives are not being met (for example, fish habitat declines in A1); and
   d. new scientific information indicates a need for change (for example, university-sponsored research indicates current management practices are leading to unintended results).
2. Accelerate learning from:
   a. formal research designed as experiments

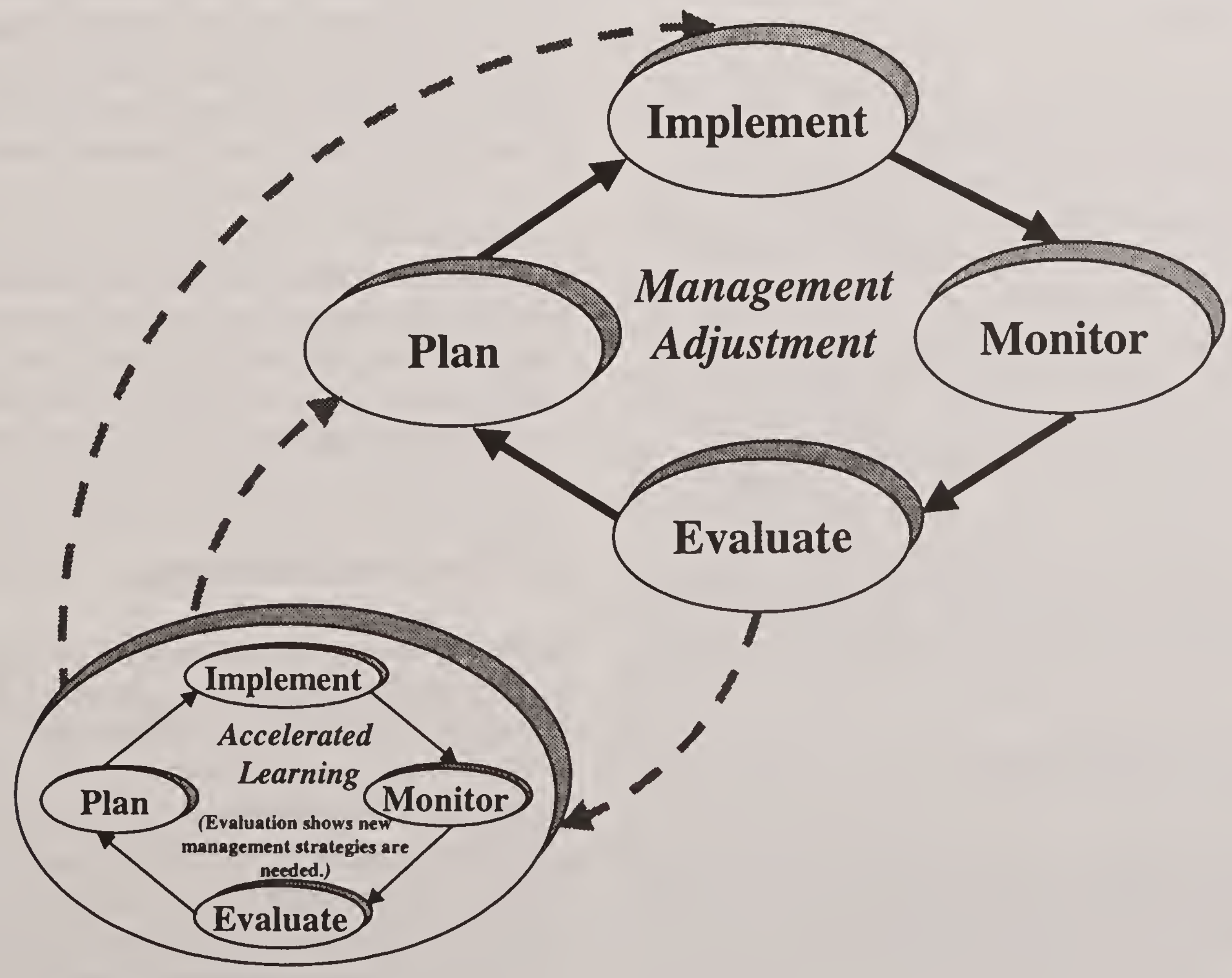


Figure 3-2. Adaptive Management

to test hypotheses about critical management issues that have high scientific uncertainty and/or are very controversial socio-economically or politically; and

b. testing the usefulness of new strategies to address management issues through the use of field trials.

The complex interrelationships of physical, biological, and social components of the ecosystem and how they will react to land management practices are often not fully understood when an ecosystem management plan is developed. To be successful, plans must have the flexibility to adapt and respond to new knowledge or conditions.

The need for an adaptive management approach can be illustrated by the following examples:

> Until the 1970s, it was commonly thought that logs and other woody debris should be removed from streams to provide for fish passage. Through the accumulation of knowledge it is our current understanding that instream woody debris is important for developing pools and other habitat for fish.

> Until the 1980s a commonly held view was that all wildfires should be aggressively suppressed to conserve forests. In recent years we have recognized that universal fire suppression has led to more frequent catastrophic fires and outbreaks of insect and diseases.

In developing the ICBEMP, the Forest Service and BLM used the best science currently available, collaborated with other governmental agencies, and involved the public. However, the agencies' knowledge evolves as society's desires change, as local environmental conditions change, as new management techniques are learned, and as the advances in science and technology are better understood. Therefore, it is inevitable that in the future, some of the management direction in this EIS will be found to be erroneous or inadequate. To address this, implementation of the ICBEMP decision will use an adaptive management approachCa continual process to modify management plans and activities to incorporate new knowledge gained over time.

Management Adjustment

B-O3. Objective. Use a continuing process of planning, implementing, monitoring, evaluating, and incorporating new knowledge into management strategies, for adjustment purposes, where: (1) a planned direction is adapted to a site-specific situation which is different than what was assumed during planning, (2) an event changes the characteristics of the environment, (3) new information accumulates over time through monitoring that indicates planned objectives are not being met; and/or (4) research indicates a need for change.

Rationale: This objective is intended to include modifications to A1 and A2 subwatersheds and T watersheds to ensure management direction and designations adapt to new information and/or site-specific conditions.

B-S8. Standard. When a land use plan amendment or revision has the potential to change the expected outcomes (described in the management direction for the ICBEMP EIS) for issues that transcend individual administrative units, the administrative unit shall consult and coordinate with the appropriate intergovernmental partners. Adaptive management modifications that require changes in Forest Service Regional Guides or Forest Service or BLM land use plans shall be adopted following applicable planning and regulatory procedures.

Rationale: BLM and Forest Service planning regulations require many or all of the same procedural steps to change a plan (amendment) as to develop a new plan (revision). These requirements include involving the public in the planning process, completing a NEPA environmental analysis, approval of proposed changes by the BLM state director and Forest Service regional forester, and an opportunity for the public to protest or appeal the final decision. This standard gives intergovernmental partners an opportunity for involvement in the process and ensures that solutions to issues that are larger than a particular planning area are designed to avoid unintended broad-scale results. The dispute resolution process, which will be a part of the ROD, will provide a mechanism for raising issues that can not be resolved by local intergovernmental partners. *Management direction* includes goals, objectives, standards, and management intent.

Accelerated Learning

B-O4. Objective. Pursue opportunities for both formal research experimentation and management-developed field trials for accelerated learning.

Rationale: The ICBEMP makes assumptions to fill the gaps in understanding of the complex interrelationships of the physical, biological, and social components of ecosystems. These assumptions are tested over time by developing and testing new manage-

ment strategies and methods, and by conducting experiments to enhance understanding. Administrative units, through the use of field trials, and scientists, through the use of formal research experimentation, can both contribute to extending the knowledge base and testing new ideas. Field trials are not designed as formal research experiments; rather they are operational trials or administrative studies, carried out with less statistical rigor and no up-front intent to publish the results in peer-reviewed publications. These trials, in contrast to formal research experiments, focus more on the outcomes of management activities, rather than on enhanced understanding of cause-and-effect relationships or on ecological processes. While it is most beneficial to know the cause of the outcomes, formal research experiments across numerous, variable site-specific areas are often more expensive than the agencies can afford.

B-S9. Standard. Formal research experimentation and management-developed field trials that require deviations from ICBEMP standards shall be submitted to the appropriate intergovernmental partners for consultation and coordination.

Rationale: Accelerating learning by experimental deviation from ICBEMP standards can be appropriate for finding new approaches to meet the goals and objectives in this EIS. ICBEMP standards were developed using the best available information regarding appropriate conditions and practices required to achieve objectives and were approved after extensive consultation and coordination with intergovernmental partners. Any variations on the standards—whether for scientifically validated research or for management projects or administrative studies—should be reviewed by all partners before approval.

B-S10. Standard. Techniques (treatments or management actions) that have limited testing by research experimentation or limited field application, whether used in management-developed field trials or formal research experimentation, should be used in aquatic A1 and A2 subwatersheds and terrestrial T watersheds only if their potential to aid achievement of the objectives outweighs their potential to prevent achievement.

Rationale: A1 and A2 subwatersheds and T watersheds have a management intent that is focused on minimizing risks to aquatic and riparian systems (A1 and A2 subwatersheds) and terrestrial source habitats (T watersheds), for example, from sediment delivery and noxious weed invasions. Objectives in A1, A2, and T areas are designed to minimize these risks. In these areas, it is possible that the risk involved in applying techniques (that is, treatments or management actions) that have limited credibility might exceed acceptable risks. Thus, for techniques with limited credibility, caution is warranted before proceeding with application.

B-G1. Guideline. When selecting areas to conduct adaptive management accelerated learning trials, weigh the potential value of information gained from evaluating management prescriptions against potential risk to the resource value(s). Select sites to test hypotheses by considering areas where risks from management can be minimized and where the value of information gained is commensurate with the potential effects.

B-G2. Guideline. Consider testing alternative approaches to standards and best management practices that are designed to meet ICBEMP goals and objectives in new ways. If such alternative approaches are used, standard B-S9 would need to be followed.

B-G3. Guideline. Consider including agency or other researchers in study design, sampling methods, data collection, management and analysis, and evaluation of management applications for activities aimed at enriching knowledge of management techniques or ecological knowledge.

Monitoring and Evaluation

Description and Management Intent

Monitoring and evaluation are an integral part of adaptive management and are key to achieving the short- and long-term goals and objectives of the Interior Columbia Basin Ecosystem Management Project. The wide diversity and variability of biophysical resources and socio-economic conditions within the project area require that ICBEMP direction be outcome-based rather than prescriptive. Success in meeting ICBEMP goals and objectives requires that the effects of this outcome-based direction be monitored and evaluated in a timely manner to determine if modifications are needed.

The intent is for the monitoring and evaluation strategy to be developed through a collaborative, intergovernmental, interagency, and interdisciplinary process; based on scientific understanding of interactions among ecosystem components and human activities; affordable; and technically feasible. It needs to be designed to accommodate many geographic levels by addressing linkages and relationships among scales in the project area (such as basin, subbasin, and watershed) by providing for both broad-scale and locally gathered information to be compiled and interpreted. This hierarchical pattern of

answering questions and measuring trends at various levels will assist in answering broad-, mid-, and fine-scale questions.

Each of the four types of monitoring will focus on different facets of this EIS. For example, implementation monitoring will determine if planned activities are being implemented and if standards and objectives are being followed. Effectiveness monitoring will determine if decisions in the ROD are effective and appropriate to achieve the desired results, using the management intent, goals and objectives, and management direction. For more information, see Appendix 10.

The intent is to present the implementation monitoring portion of the monitoring plan with the ROD and complete the remainder of the monitoring plan within two years after the ROD is signed.

B-O5. Objective. Monitor the broad-scale health and integrity of ecosystems in the project area, to determine ecological and economic status and trends, provide linkage to finer scales, and provide the basis for changes in management direction through adaptive management.

Rationale: Monitoring plays a pivotal role in the adaptive management process, primarily to detect undesirable changes early enough that management activities can be modified to work toward achieving the desired goals and objectives of the ICBEMP ROD. Information developed through monitoring will be used to evaluate management strategies, alter decisions, change implementation, or maintain current management.

B-S11. Standard. Forest Service and BLM administrative units shall contribute resources to collect, store, and interpret information needed to implement a broad-scale monitoring plan, which will be jointly developed by Forest Service regional offices and BLM state offices through collaboration with intergovernmental partners.

Rationale: *Intergovernmental partners* include other federal agencies, state and local governments, tribal governments, resource advisory committees, and provincial advisory councils.

B-O6. Objective. Evaluate broad-scale monitoring data every five years to determine if the ICBEMP ROD is being implemented and if management practices are leading to achievement of the broad-scale goals and objectives.

Rationale: It is critical to conduct evaluations to determine whether ICBEMP standards are being implemented as intended and if they are meeting goals and objectives. Broad-scale ecosystem changes occur slowly over time. Management evaluations made too frequently may not detect changes in the ecosystem because cost-effective monitoring systems are not sensitive enough to detect them. However, if ecosystem management evaluations are not conducted, or are delayed for too long, irreversible changes may take place without detection. Local evaluations are useful for determining if local management strategies are contributing to meeting broad-scale management objectives, while broad-scale evaluations are useful for determining if, on the whole, broad-scale management objectives are being met.

Management Direction — Base Level

Description and Management Intent: Overall

Forest Service- and BLM-administered lands throughout the project area would be covered by management direction in existing land use plans, recovery plans, and other current direction related to threatened or endangered species, augmented or amended by specific base level direction (standards and objectives) in the ICBEMP Record of Decision.

Complying with objectives and standards in the base level direction generally means that the Forest Service and BLM must implement actions to maintain or promote desirable resource conditions. The specific location, timing, and intensity of these management actions would depend on acceptable levels of risk determined at the local level. Determining acceptable levels of risk entails considering both the risks from management actions and the risks from not conducting any activities, in the short term and long term. It also involves considering fine-scale risks in the context of larger scale processes and conditions.

Some of the direction specifically indicates that it applies in either the short term (up to 10 years) or in the long term (more than 10 years), or that it specifically addresses short-term risk or long-term risk. Although the emphasis may be on the short or long term, it is recognized that the situation is never that black and white. While it is important to understand the emphasis, the intent is to consider both types of risks in local-level decisions. In many cases short-term impacts could result from implementing management actions (such as road decommissioning) to

attain objectives. The intent is to analyze and weigh the risks and benefits to the various resources in the local decision-making process.

Alternative S2 Only. *In Alternative S2, there is a greater emphasis on minimizing short-term risk from management activities, especially risk to threatened, endangered, or proposed species habitats and to riparian areas.*

Alternative S3 Only. *In Alternative S3, there is a greater emphasis on minimizing long-term risk either from management activities or from disturbance events. This would occur through accepting more risk from management activities in the short term, within the requirements of the Endangered Species Act, Clean Water Act, and Clean Air Act.*

Where ecosystems are in good condition, base level management direction requires that they remain in good condition. Where ecosystem conditions are not as good, the intent of base level direction is to keep the conditions from deteriorating further until they can be actively or passively restored.

Base level direction is intended to be accomplished in an integrated fashion, because landscape dynamics, terrestrial habitats, aquatic habitats, and human components are inseparable. Rangeland, forestland, aquatic areas, riparian areas, and their associated species are intertwined, through spatial overlap, foodwebs, and the flows and cycles of energy, nutrients, and water, all functioning within the context of the desires and needs of society. Base level direction addresses both short-term and long-term integrated needs by maintaining resource conditions. Where ecosystems are in good condition, management direction requires that they remain in good condition. Where the condition of ecosystems is not as good, the intent of base level direction is to keep the conditions from deteriorating further until they can be restored either passively or actively. The restoration-focused management direction is in a separate section, which follows the base level direction section.

Alternative S2 Only. *In Alternative S2, there is a greater emphasis on locating management activities in areas where short-term risk would be minimized.*

Alternative S3 Only. *In Alternative S3, there is a greater emphasis on locating management activities and producing commodity products near isolated and economically specialized communities, including tribal communities. These areas are shown on Map 3-6 and Map 3-7, later in this chapter.*

Management direction for threatened, endangered, and proposed species would apply to habitats used by those species. Generally, the intent for management of these areas is to protect the threatened, endangered, or proposed species habitats and to contribute to species recovery. See the Aquatic and Terrestrial Threatened, Endangered, or Proposed Species section for additional description of management intent.

Management direction for Riparian Conservation Areas (RCAs) is included under base level direction because it applies to RCAs throughout the project area. RCA direction will replace direction for riparian areas in existing land use plans (including PACFISH and INFISH) and can not be superseded by less restrictive direction. See the Aquatic/Riparian/Hydrologic Component and RCA sections for additional description of management intent for RCAs.

Management for terrestrial source habitats is conditional base level direction and would apply where these habitats exist. (See Appendix 5 for cover types that are terrestrial source habitats.) Unless otherwise specified, reference to terrestrial source habitats in this section is intended to encompass habitat for all 12 Terrestrial Families described in the *Terrestrial Source Habitat Analysis* (Wisdom et al. in press).

Landscape Dynamics Component

Description and Management Intent

Direction in this section focuses on landscape-level processes and functions. Landscapes are healthy when their components and processes are functioning properly, in the context of the desires and needs of society. Landscape considerations include succession/disturbance regimes (such as fire, flood, windthrow, insects, and disease) and processes (such as the flows and cycles of energy, nutrients, and water), and their dynamics. Succession/disturbance regimes that are in concert with the climate, landform, and biological and physical characteristics of the ecosystem provide for terrestrial and aquatic habitats, intact hydrologic processes, continuous and predictable flow of products, and continuous land uses. Direction for the landscape dynamics component provides the foundation for specific additional direction for aquatics, terrestrial wildlife and plants, and social-economic needs (including tribal rights and interests), and provides the thread that connects and integrates the individual components.

Landscape dynamics direction provides the foundation for additional aquatics, terrestrial wildlife and plants, and social-economic needs (including tribal rights and interests) direction, and provides the thread that connects and integrates the individual components.

Ecosystem Processes and Functions

B-O7. Objective. Preserve future management options and prevent further declines in landscape processes and functions by maintaining and promoting (a) healthy, productive, and diverse plant and animal communities as appropriate to soil type, climate, and landform (terrestrial source habitats); and (b) ecological processes of nutrient cycling, energy flow, and the hydrologic cycle.

Rationale: This objective provides the foundation for base level direction that not only emphasizes native plant communities and animals, and their source habitats, but also the requirements of maintaining ecosystem processes, functions, and characteristics. The emphasis is on native animals and plants; however, at times non-native animals and plants are acceptable. For example, it is often necessary to use non-native species where native plant communities cannot be maintained or restored with current technology and knowledge, such as in low precipitation cheatgrass areas and for crested wheatgrass seedings.

Management direction for landscape restoration is primarily found in the objectives and standards of the Restoration section of this chapter. However, in the short and long term some restoration activity is to be expected in base level areas (that is, outside identified as high restoration priority subbasins, and outside A1, A2, or T areas). Through finer scale or locally important restoration emphases, parts of the landscape can be made resilient to disturbance in the short term, so they can act as buffers or fuel breaks for higher hazard areas or important areas on the landscape. In this way, managers can prevent further declines in landscape processes and functions to preserve long-term management options.

B-O8. Objective. Management actions should sustain hydrologic processes characteristic of the geoclimatic settings. Hydrologic processes critical for balanced landscapes/ecosystems include, but are not limited to, stream flows and sediment in channels.

Rationale: Broad-scale geoclimatic settings influenced by time and disturbances produce landforms, soils, and vegetation with inherent variability in performance elements such as stream channel form, large wood, stream flow and sediment regimes. *Stream flow regimes* include timing, magnitude, duration, and spatial distribution of peak, high, and low flows. *Sediment regimes* include timing, volume, rate, and character of sediment input, storage, and transport. Characteristic stream flows (including floodplain inundation and water table elevation) and sediment regimes are essential to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing.

B-O9. Objective. Manage vegetation structure, stand density, species composition, patch size, pattern, and fuel loading and distribution to reduce the prevalence of uncharacteristically large and severe disturbances; and so the landscape succession/disturbance regimes and terrestrial source habitats are resilient to natural disturbances such as wildfire, insects, disease. Priority should be given to whole hydrologic units if resources are available and if the landbase allows for it.

Rationale: Maintenance of vegetation characteristics and the biological crust component (particularly in the dry rangeland plant communities) that contribute to the resiliency of plant communities to disturbance is fundamental to a healthy ecosystem. *Vegetation structure* is the height, size, and age of vegetation. *Composition* is the percent of each species occurring on a site. Vegetation treatments may include prescribed fire and planning for appropriate wildfire suppression response. See also the rationale for B-O7.

B-G4. Guideline. Consider fragmenting large patches of shade-tolerant species that are outside the desired condition. Break up their continuity and decrease horizontal landscape homogeneity, consistent with landform, climate, and biological and physical characteristics of the ecosystem and natural disturbance regimes.

B-G5. Guideline. Consider matching vegetation patch sizes to local predicted disturbance regimes.

B-G6. Guideline. Consider using fire as a management tool within and across landscapes. Through prescribed fire plans use management actions that will reintroduce fire as a natural disturbance process and help achieve desired conditions, such as maintenance and/or restoration of source habitat(s) for terrestrial vertebrates.

Rationale: Fire is an important component of the succession/disturbance regime of the project area. Whenever possible, it should be used to repattern vegetation on the landscape to patches more consistent with the landform, climate, and biological and

physical components of the ecosystem. There are places within the project area, however, where vegetation and fire regimes have changed so much since historical times, that fire without some type of preparatory activities would not move the ecosystem toward desired conditions, or may be detrimental to the ecosystem.

B-G7. Guideline. Consider "wildland fire use for resource benefit" as a means of managing extensive areas of insect- and/or disease-infested forests that have already lost their salvage value or are otherwise uneconomical to treat.

B-G8. Guideline. To the extent that fuel amounts, arrangements, and management objectives allow, conduct management-ignited prescribed fire activities at frequencies and intensities similar to the natural fire regime appropriate to the site.

B-G9. Guideline. Use available tools, such as fire behavior, fuel loading, duff composition, and tree mortality models, to determine where desired stand conditions can be attained with prescribed fire treatments or where stand conditions or other hazards require mechanical thinning prior to prescribed fire treatment. Where necessary, use thinning and/or mechanical fuel reduction in combination with prescribed fire.

B-G10. Guideline. Consider both managed fire and "wildland fire use for resource benefit" as management tools. "Wildland fire use for resource benefit" can be a more important tool after stands have been restored to a fire-resistant condition or are desired to be in a severe fire regime.

B-O10. Objective. Land uses such as livestock grazing (including the season, timing, frequency, duration, and intensity of livestock grazing pressure), and where applicable, timber harvest and recreation, should provide:

a. Adequate cover (live plants, plant litter, residue, and/or biological crusts) to promote infiltration, soil water storage, and maintain soil stability in upland areas;
b. Adequate cover and plant community structure in riparian-wetland areas to promote the attainment of proper functioning condition (BLM Technical Reports 1737-9 [USDI/BLM 1993] and 1737-11 [USDI/BLM 1994b]);
c. (1) Soil surface conditions that support infiltration; (2) soil subsurface conditions that ensure movement of soil water into the soil profile; and (3) the combination of soil surface and soil subsurface conditions in (1) and (2) which will ensure soil water storage;
d. As minimal an increase and spread of noxious weeds as possible, over and above the inherent increase and spread of noxious weeds by natural disturbances (such as wildfire);
e. Soil and vegetation conditions that provide opportunity for establishment of desirable (that is, native and desired non-native) plants; and maintenance of plant vigor for seed production, seed dispersal, and seedling survival of desired species;
f. Maintenance and restoration of water quality;
g. Maintenance and the opportunity for restoration of terrestrial source habitat (that is, cover type-structural stage combinations) patch size and density that are in synchronization with the succession and disturbance regimes governed by climate, landform, and soils; and
h. For reduction of the potential conflicts be-tween domestic sheep and bighorn sheep.

***Rationale*:** This objective is taken from Healthy Rangelands Guidelines, which the BLM currently is implementing. It is a comprehensive base level objective, which is consistent with both the aquatics and terrestrial habitat portions of the ecosystem management strategy. The Healthy Rangelands guidelines that were used as the basis for this objective focused on livestock grazing management. However, most if not all land uses should provide for these functions and processes, if feasible. It is understood that in some cases (for example, copper mining or an off-road vehicle park) it would be impossible to provide for all these functions and processes while permitting the use. Therefore, tradeoffs must be expected for some land uses.

Bullet "a" is intended to interpret vascular plant material (live and dead) and biological crusts (that is, microbiotic crusts) together, as contributing to cover. Both vascular plant material and biological crusts contribute to infiltration, soil water storage, and soil stability, to various degrees on various soil types and soil textures. In addition, the degree of biological crust development and vascular plant production varies by soil type, soil texture, precipitation, and other factors.

Bullet "b" is intended to foster land uses that are compatible with riparian-wetland area improvement and that will provide for proper functioning condition (PFC) of both lotic (running water habitat such as rivers, streams, and springs) and lentic (standing water habitat such as lakes, ponds, seeps, bogs, and meadows) riparian areas. The intent is for PFC to be the *minimum* threshold for management of riparian-

wetland areas, with the expectation of vegetation community succession *beyond* PFC to some desired plant community.

Bullet "c" is intended to foster land uses that avoid subsurface soil compaction slowing the movement of water in the soil profile.

Bullet "d" is intended to manage land uses so as to minimize the rate of noxious weed spread, given that the spread of noxious weed seed cannot be totally prevented where land uses and noxious weeds occur together. Subsequent weed control actions would help prevent the increase and spread of noxious weeds. Thus although land uses might contribute to noxious weed increase and spread, the intent of this objective is to modify, not prohibit, land uses so noxious weed spread is minimized, and to recognize that land uses might need to be combined with weed control.

Bullet "e" is intended for land uses to not diminish the ability of plants to produce seed or vegetation sprouts (below that which is occurring because of recent climatic conditions). For soil conditions, the intent of this objective is (1) achievement of bullet "c", because soil surface conditions that support infiltration will provide opportunity for establishment of desirable plants; and (2) maintenance of biological crusts (see bullet "a"), because recent science findings are beginning to provide evidence that in some situations intact biological crusts can have a positive role in plant establishment.

Bullet "g" is <u>not</u> intended to assert that land uses should be used as a restoration tool to achieve certain terrestrial source habitats (that is, certain cover type-structural stage combinations). Rather, the objective is intended to permit land uses that do not <u>prevent</u> appropriate cover type-structural stage combinations from persisting in expected patch sizes and densities across and within landscapes. For example, livestock grazing management strategies could be promoted if they would not shift fire frequency, fire severity, and successional patterns to the point where grassland-shrubland cover types and structural stages would be affected by encroachment of woody species and increased density of woody species, or where ponderosa pine and mixed-conifer forest structural stages would be affected by increasing density of trees.

Bullet "h" is intended to reduce conflicts between domestic sheep and bighorn sheep. Such conflicts can have negative consequences for both wildlife and livestock. Numerous research studies and monitoring of bighorn sheep "die-offs" have indicated a high correlation between die-offs and contact between domestic sheep and bighorn sheep.

B-S12. Standard. If livestock grazing management is a factor in causing an area to function "at risk", then that area shall be high priority to initiate changes to livestock grazing management.

***Rationale*:** There is agreement among rangeland scientists that areas 'at risk' of crossing a threshold, and thus progressing to a lower (more degraded) successional state, should be prevented from crossing the threshold. Modifying livestock grazing management in these areas can prevent these areas from crossing a threshold to a more degraded state, thereby achieving improvement in rangeland condition and source habitats used by terrestrial rangeland vertebrates, such as sage grouse. Areas can be identified through processes such as landscape analyses, allotment management planning, or rangeland health rapid assessment process (USDI/BLM 1999).

B-G11. Guideline. One means of reducing conflict between domestic and bighorn sheep is to phase out (close) individual livestock allotments as they become vacant within occupied habitat. Habitat is considered occupied if bighorn sheep are currently present, or if they would be expected to disperse into the area in the next 10 years.

B-G12. Guideline. On rangelands, consider locating water development, fencing, salt, and supplements on upland areas to keep domestic livestock from congregating in riparian areas.

B-G13. Guideline. Consider developing livestock waters, seedings, and other projects that concentrate livestock use in areas (1) that do not conflict with wintering wildlife, and (2) that will not be opening up new ground for livestock grazing that has not been used by livestock in the past.

B-G14. Guideline. Prior to making adjustments to livestock use as a result of conflicts with big game species, consider determining whether:

- There is dietary overlap.
- The area is in good or degraded range condition.
- The use is seasonally different.
- The livestock use is conditioning the forage for big game.
- The big game population is decreasing.
- The area is winter range.
- The area provides important fawning, calving, or lambing areas.

B-G15. Guideline. On dry shrublands, consider the following to maintain soil, biological crust, and vegetation health and productivity during drought periods:

- Spring/fall or winter grazing instead of spring/summer/fall.
- Shorter duration/lower intensity grazing .
- Avoidance of grazing during the growing season (when perennial grasses are actively growing, and during the more critical boot-to-seed-ripe stage).
- Fewer head of livestock along with fewer days.
- Encourage greater flexibility in ranching operations to respond to changing range conditions.
- Incorporate more years of deferment or rest into grazing systems (for example, one year on and two years off, or two years on and two years off) to improve the rangeland's ability to handle dry conditions. (Traditional three-pasture systems that provide only one year of rest and two years of critical growing season grazing are not sufficient in some dry shrublands to maintain desirable resource conditions during drought conditions.)

B-G16. Guideline. During planning or other appropriate processes, consider leaving pastures or allotments vacant or open for use by livestock permittees or lessees who are affected by AUM reductions in their normal areas of use due to wildfire or measures to protect riparian areas or threatened, endangered, or proposed species.

B-G17. Guideline. The following techniques may be used to help control or rehabilitate cheatgrass-dominated ranges:

1. Intensive early spring grazing in cases where soils, remnant native perennial plants, and biological crusts will not be adversely affected;
2. Herbicides, especially in combination with burning or plowing.

Noxious Weeds

B-O11. Objective. Maintain noxious-weed-free plant communities (cover types) or restore plant communities with noxious weed infestations through use of broad-scale integrated weed management (IWM) strategy(ies).

Rationale: The rapid expansion of noxious weeds in the project area is one of the greatest threats to healthy native plant communities. Noxious weeds are reducing the value of these plant communities in several ways, including:

1. decline in quality of aquatic-riparian and terrestrial habitats for wildlife;
2. reduction of forage for grazing animals;
3. potential increase in soil erosion;
4. potential decline in water quality;
5. reduction in biological diversity;
6. negative impacts on or declines in native plant resources associated with the interests or reserved rights of American Indian tribes (see Native Plants section of Appendix 8 for a partial list of plants); and
7. increase in the economic burden of maintaining the quality of recreation and wilderness areas. Uncoordinated efforts throughout the project area have been ineffective against noxious weeds. Noxious weed strategy(ies) need to be consistently implemented project-area wide to reduce the negative impacts of noxious weeds. This objective hinges on a project-area-wide integrated weed management strategy being developed by Forest Service regional and BLM state office staffs, in collaboration with other federal, tribal, and state officials.

B-S13. Standard. Broad-scale integrated weed management (IWM) strategies shall incorporate these goals:

a. Education and awareness
b. Prevention of weed spread
c. Detection, inventory, and mapping
d. Planning
e. Integrated methods of weed control
f. Collaboration and coordination with federal, state, and local agencies; tribal governments; and others, as appropriate
g. Monitoring, evaluation, research, and technology transfer. (See Appendix 11.)

Rationale: Uncoordinated weed control efforts throughout the project area have been ineffective against noxious weeds. Negative impacts attributable to noxious weeds can be reduced more rapidly if noxious weed strategy(ies) are consistently implemented project-area wide. This standard lists seven goals that form a *consistent* framework for IWM strategy(ies) to be implemented by the BLM and

Forest Service. This standard amends existing BLM and Forest Service IWM strategies to incorporate the seven goals if they are not currently an emphasis of the strategies.

B-S14. Standard. A1 and A2 subwatersheds, and terrestrial source habitats in T watersheds (see objective T-O1) have the highest broad-scale priority for implementing IWM strategy(ies). Management shall be focused on preventing noxious weed spread into and within A1, A2, and T, and eradication of existing infestations if possible. Existing and future noxious weed inventory information obtained within A1, A2, and source habitat within T shall be used, along with the *Susceptibility of Vegetative Cover Types to Invasion by Noxious Weeds* (see Tables 2-35 and 2-36, in Chapter 2), to first address cover types rated as High, then address cover types rated Moderate, and finally address cover types rated Low. In particular, goals "b" (prevention of weed spread), "c" (detection, inventory, and mapping), and "e" (integrated methods of weed control) from Standard B-S13 shall be incorporated.

The remaining base level areas have a lower broad-scale priority for maintaining noxious-weed-free plant communities (cover types) or restoring plant communities with noxious weed infestations.

Rationale: This standard focuses on using a science-based, noxious weed susceptibility index (*Susceptibility of Vegetation Cover Types to Invasion by Noxious Weeds*) to prioritize at a broad scale where prevention of weed spread; detection, inventory, and mapping; and integrated methods of weed control are implemented within vegetation cover types in the A1, A2, T, and base level areas. However, broad-scale prioritization does not preclude noxious weed control efforts in other areas. For example, ongoing or future agreements with state, county, tribal, or local entities may shift some weed control funding to areas with local noxious weed concern that may have a higher priority than those identified at the broad scale.

B-G18. Guideline. Where possible, con-sider prioritizing weed management as follows:

- Prevent invasion of new invaders by limiting weed seed dispersal, minimizing soil disturbance, and properly managing desirable vegetation.
- Detect and eradicate new invaders.
- Target roadways, water courses, campgrounds, along trails and railways, and other high disturbance areas for a constant prevention and containment program.
- Emphasize control of large-scale infestations (limiting the spread of noxious weeds and reducing the infestation level).
- Focus initial efforts on small, manageable units with an understory of residual plants, and then focus on the remaining infestation. Start with the outside and work toward the center of the infestation.
- Consider using native, locally adapted species for rehabilitating weed-infested lands and bare ground.

B-G19. Guideline. While attempting to prevent the spread of noxious weeds into areas that are susceptible to invasion, consider rangeland vegetation cover types that are of high or moderate susceptibility to invasion. See Appendix 11 for a table that portrays the rangeland cover types in the project area and their susceptibility to invasion by noxious weeds.

B-G20. Guideline. Consider developing cooperative weed prevention programs with suppliers of sand, gravel, top soil, seed, hay, straw, ornamental plants, and any other materials that may transport seed and other reproductive plant parts of noxious weeds.

B-G21. Guideline. Consider developing control strategies targeted and tailored to specific noxious weeds. Consider combining cultural, physical, biological, and chemical methods into a control strategy.

B-G22. Guideline. Because weeds are not adapted well to shade, consider retaining shade along roads by minimizing removal of trees and other roadside vegetation during construction, reconstruction, and maintenance, particularly on south aspects.

B-G23. Guideline. To minimize transport of weed seed by pack and saddle stock:

a. Consider requiring pack and saddle stock to use only certified weed-free feed and straw bedding in designated areas. Where applicable in wilderness areas, this technique should be deferred to the Limits of Acceptable Change planning process. Encourage the use of weed-free feed in all areas. (Visitors to National Forest System lands are now required to use certified noxious-weed-free hay, straw, or mulch in Idaho and Montana);

b. Consider requiring pack and saddle stock to be quarantined and fed only weed-free feed for 24 hours before traveling off roads. Before quarantine, tail and mane should be brushed out to remove any weed seed.

B-G24. Guideline. To minimize transport of weed seed to relatively weed-free areas that are at moderate to high susceptibility of invasion, consider controlling the timing of livestock movement from infested to non-infested areas, especially in range allotments that have both weed-infested and relatively weed-free areas that are at moderate to high susceptibility of invasion. Consider permitting livestock to graze weed-infested areas only when weeds are not flowering or producing seeds, or, if livestock are grazing weed-infested areas, consider moving them to a holding area for about 14 days before moving them to weed-free areas.

B-G25. Guideline. To ensure that fire suppression and rehabilitation efforts minimize weed spread, consider reseeding all disturbed soil in relatively weed-free areas that are at moderate to high susceptibility of invasion.

B-G26. Guideline. Consider using grazing management practices where feasible for wildfire control and to reduce the spread of targeted undesirable plants (such as cheatgrass, medusahead, and noxious weeds) while enhancing vigor and abundance of desirable native or seeded species.

B-O12. Objective. Initiate collaboration with affected federally recognized tribes on noxious weed control programs.

Rationale: Tribes affected by management actions in the project area share BLM and Forest Service concerns with the increasing trends and adverse impacts of noxious weed invasions. Tribes are generally supportive of noxious weed control actions and have increasing numbers of trained personnel in their own programs. Some tribes may be interested in assisting BLM and Forest Service noxious weed control actions, especially where a mutual benefit might be realized.

B-S15. Standard. Planning and implementation of noxious weed control actions should consider effects on plant resources that are culturally significant to tribes (for example, timing of weed treatment and associated health considerations regarding harvest of affected plant species).

Rationale: Collaboration with tribes, county agencies, and federal agencies will help to ensure plant resources and effects on these resources of tribal interest are considered and integrated into planning and implementation of noxious weed control actions. Furthermore, because these plants tend to be seasonal in nature, there are tribal health concerns regarding ingesting or gathering plants in areas where efforts are underway to control noxious weeds; collaboration with affected tribes could result in design of actions so that timing or type of treatment mitigate these concerns.

Unstable and Potentially Unstable Lands

B-O13. Objective. On unstable or potentially unstable lands (outside RCAs), design management activities to not increase the natural frequency and distribution of landslides.

Rationale: Mass soil movement is part of a mountainous watershed's natural disturbance regime. Mass soil movement types and frequency of events are variable throughout the project area. Inputs of material from mass soil movements, such as coarse sediments and wood, can be beneficial to aquatic and riparian habitats. The management intent is to prevent above-natural rates in the frequency and distribution of landslides due to management activities by maintaining important hydrologic processes on unstable and potentially unstable lands. Important hydrologic processes include, but are not limited to, interception or concentration of surface or subsurface flow, infiltration rates, retention of wood, and evapotranspiration rates.

B-S16. Standard. Until a land use plan is revised, unstable and potentially unstable lands shall be identified as part of any proposed project planning prior to conducting management activities. In order for management activities to not increase the frequency and distribution of landslides, management actions on unstable and potentially unstable lands outside RCAs should retain dominant hydrologic functions and processes that influence landslides.

Rationale: Proposed management activities (for example, road construction and vegetation removal) can disrupt hydrologic processes and accelerate the natural frequency and distribution of mass soil movements, thereby resulting in negative impacts on aquatic habitats. Identification of unstable and potentially unstable lands is necessary to properly develop and design proposed management activities on these lands. The intent is to use existing information/data, not to initiate a field inventory effort.

B-S17. Standard. During land use plan revision, the dominant mass soil movement types within the administrative unit's planning area shall be identified and their effects on allowable sale quantity calculation addressed. Use analytical methods that identify unstable and potentially unstable lands with regard to dominant mass soil movement types and the probability of failure. Management direction shall be stratified according to probability of failure to retain hydrologic functions and processes (for example, interception or concentration of surface or subsurface

flow, infiltration rates, evapo-transpiration rates) so that frequency and distribution of landslides are not increased due to management actions and so that management actions contribute to attaining aquatic and riparian objectives. During site-specific NEPA analysis and planning, land use plan-level unstable and potentially unstable lands map shall be refined and ground-truthed.

Rationale: The intent of this standard is to not increase the frequency and distribution of landslides. It is intended to direct how land use plan revision will address unstable and potentially unstable lands. It is not intended to take specific acres of unstable lands out of the timber base, but to facilitate adjustments to the allowable sale quantity to take into account their effect on management options.

Fire Management and Air Quality

B-O14. Objective. Protect, maintain, and/or improve air quality on Forest Service- and BLM-administered lands in the project area. Evaluate the long-term improvements in summer air quality compared with the short-term deteriorations to spring and fall air quality that come with prescribed burning. Manage these short- and long-term risks to air quality.

Rationale: The biggest danger to broad-scale air quality in the project area comes from smoke generated by wildfire. In much of the interior Columbia Basin, biomass production greatly exceeds decomposition rates. Years of wildfire suppression have led to huge accumulations of biomass. This biomass can be mechanically removed from the site to prevent undue smoke from wildfires; however, it is generally costly and removes needed nutrients from the site.

Land managers have little control over where, when, and how much smoke is put into the air during wildfires. Through prescribed fire, smoke levels can be better managed. For example, air quality can be somewhat diminished in the short term so that the likelihood of violating air quality standards in the long term are diminished.

B-O15. Objective. Use prescribed fire to reverse the declining trend in air quality.

Rationale: Through prescribed burning, overall air quality can be improved by: (1) moving some of the smoke to spring and fall when fuel and air conditions are cooler and more moist; (2) reducing the size of wildfires; (3) reducing the severity of wildfires; and (4) managing cumulative effects from prescribed fire smoke.

B-S18. Standard. Prior to any prescribed burning, the risks and benefits to air quality of using prescribed fire shall be compared to risks and benefits of alternative methods of modifying vegetation, habitat, and fuels. If the vegetation to be treated with prescribed fire can be modified through an alternative method that on balance (considering cost, risks, and benefits) will achieve equivalent or better fuel load reduction and also provide other benefits not achievable with prescribed fire, the alternative method shall be used.

B-S19. Standard. Prior to any prescribed burning, the existing air quality monitoring network shall be identified and described. If needed, a plan to revise or expand monitoring shall be developed to ensure that impacts of prescribed burning on air quality in local communities are measured. Install and use the monitoring network, as revised, to document the magnitude and extent of air quality impacts from prescribed burning. Use available data to determine whether additional mitigation measures are necessary, to help determine the source(s) of the emissions (whether from prescribed fires, wildfires, or "wildland fire use for resource benefit"), and provide information for future cumulative impact assessments, including new regulations on particulate matter regional haze.

B-O16. Objective. Decisions on management of wildfires and effects on air quality from prescribed burning should be considered in the context of impacts from other sources of particulate matter in the project area, within and across administrative jurisdictional boundaries. Administrative units (national forests and BLM districts) should work with federal, state, tribal, and local air quality management agencies to develop a basin-wide smoke management plan.

Rationale: The intent is to preclude impacts from multiple sources that could collectively produce severe visibility problems and/or particulate levels that present health risks. This would include impacts from non-federal sources such as forest, rangeland, and agricultural burning.

Management of particulate emissions is complicated and crosses many jurisdictional boundaries. Although it may be difficult to develop, a basin-wide plan would provide a better means of air quality management and coordination than current plans do. Restoring fire to the ecosystem is a key part of sustainability of many parts of the project area. The Forest Service and BLM have considerable knowledge of wildland fires; therefore, administrative units should be active players in facilitating and developing a basin-wide plan.

B-S20. Standard. Prior to any prescribed burning activity or decision to use wildfire to achieve management objectives, appropriate local, tribal, state, and adjacent state air quality management organizations shall be consulted. If such consultation results in a determination that other burn activities are underway or planned in areas or at times that would likely intensify negative air quality impacts from the planned burn, additional mitigation measures shall be explored in collaboration with the other organizations to minimize such multiple impacts to the extent practicable.

B-O17. Objective. Initiate collaboration with public and private landowners to increase safety in the urban–rural–wildland interface. Work together to reduce risk from natural disturbance by: reducing live and dead fuel loading, ladder fuels, and ignition sources; thinning forests to reduce tree density; creating single story structures; favoring shade-intolerant species; maintaining low risk of crown fires; and using prescribed fire to maintain low fuel levels.

Rationale: Protecting property and life is a high priority in urban–rural–wildland interface areas. Although floods, wind, and other disturbances must be considered, reducing risk of wildfires generally is the most important consideration. In areas that often contain mixed ownerships, safety can be improved with proper cooperation and action.

B-O18. Objective. Incorporate wildland fire into existing planning processes and assessments, recognizing its essential role as an ecological process. Clearly defined fire management goals, objectives, and actions should be developed and updated in comprehensive fire management plans. Wildfire management strategies and suppression activities should minimize damage to long-term ecosystem function, and should emphasize protection, restoration, or maintenance of key habitats.

Rationale: Strategic watershed-scale fuel management and fire use planning, often integrating a variety of treatment methods, will cost-effectively reduce fuel hazards to acceptable levels and achieve both ecosystem health and resource benefits. Fire management programs and activities should be based upon protecting resources, minimizing costs, and achieving land management objectives. They must also be economically viable.

Sound risk management is a foundation for all fire management activities. Risks and uncertainties relating to fire management activities must be understood, analyzed, communicated, and managed as they relate to the cost/consequences of either doing or not doing an activity.

B-S21. Standard: Ecosystem-based fire management plans shall: (1) provide for firefighter and public safety; (2) promote the reintroduction of fire as a natural ecological process through use of various suppression strategies and prescribed fire; and (3) be integrated with fire management plans of adjacent administrative units, particularly with respect to smoke management.

Rationale: Having fire management plans in place will provide for restoration of fire in appropriate circumstances. The plans can provide direction to suppression teams. In areas rated as high or moderate risk for intense fire, crown fire, and/or urban–wildland–interface, it is particularly important that management plans include discussion of appropriate suppression actions to provide for safety and allow for natural ecological process.

Public health and environmental quality are important considerations in fire management plans and activities. Trade-offs will often exist. Short-term consequences may be acceptable to promote long-term gains and sustainability. Elements of fire management programs must be designed to promote healthy, sustainable environments. Both naturally occurring fuels and hazardous fuel accumulations resulting from resource management and land use activities must be addressed.

B-O19. Objective: Use fire to restore and/or sustain ecosystem health based on sound scientific principles and information and balanced with other societal goals, including public health and safety, air quality, and other specific environmental concerns.

Rationale: The relative success of fire suppression efforts of the past several decades has caused numerous unintended effects. Some of these include: build-up of fuels, increases in less-fire-resistant species, and more multi-story stands. These have led to changes in fire regimes from non-lethal to lethal and wildland fires that cause considerable damage to resources and considerable costs to suppress. The Federal Wildland Fire Policy and Program Review has directed federal agencies to make numerous changes to reverse the adverse effects across vast areas.

B-G27. Guideline: Consider the use of non-fire treatments (for example, mechanical, chemical, biological, and manual methods) where wildland fire cannot be safely reintroduced because of hazardous fuel build-ups, particularly in urban–rural wildland interface areas.

B-G28. Guideline: Consider conducting prescribed fires during the time of year when fires would have normally occurred if resulting effects match desired outcomes and fire can be controlled within a defined target area.

B-O20. Objective: Maintain preparedness planning and fire suppression programs to prevent unacceptable loss from fire.

Rationale: Integrating fire into land management is not a one-time, immediate fix but a continual, long-term process. It is not an end in itself but rather a means to a more healthy ecosystem. Agency commitment to sharing information internally and externally regarding fire and other ecological processes is needed. Adaptive and innovative fire and land management is limited when agency employees and the public misunderstand or remain skeptical about the role of fire. The ecological and societal risks of using and excluding fire need to be better clarified and quantified to allow open and thorough discussions among managers and the public.

B-O21. Objective: Coordinate and collaborate the planning and implementation of watershed-scale wildland fires across administrative boundaries to manage fuels, restore or maintain ecosystems, and obtain desired distribution of vegetation patches and patterns.

Rationale: Federal, state, tribal, and local interagency coordination and cooperation are essential to implement successful fire management programs. Increasing costs and smaller work forces require that public agencies pool their resources to successfully deal with increasing and more complex fire management tasks. Collaboration among federal agencies and between federal, state, tribal, and local governments, and private entities results in a mobile fire management work force available for public needs.

B-O22. Objective: Prescribed fire should be considered in designated wilderness areas where it has been determined that "wildland fire use for resource benefits" will not achieve desired rates of ecosystem maintenance or restoration.

Rationale: In some areas designated as wilderness, the number and acres of fires managed to achieve resource benefits will not be adequate to mitigate effects of insects, disease, or unplanned wildland fires; reduce crown fire potential; reduce fire and smoke risk to urban–rural–wildland interface; or protect important aquatic and terrestrial areas. In these cases, prescribed fire could be used to achieve resource benefits.

Road Management

Description and Management Intent

The challenge is to design and maintain a road system that provides the benefits of access but minimizes adverse road-related effects on other resources, such as water quality, fish, and wildlife.

The road system on federally administered lands is extensive and diverse. New science information, particularly that generated by the ICBEMP Science Integration Team and Science Advisory Group, indicates that roads are a significant modifier of landscapes and ecological processes. At the same time, roads are needed for public access and tribal needs as well as for accomplishment of many management objectives. The challenge is to design and maintain a road system that provides the benefits of access but minimizes adverse road-related effects on other resources, such as water quality, fish, and wildlife.

ICBEMP road direction is intended to accomplish the following:

1. Roads determined to be no longer needed will be closed or obliterated and ecological values restored;
2. Roads determined to be needed for land management, public access, and tribal rights will be safe, promote efficient travel, and be improved as needed to minimize adverse environmental effects;
3. New road construction will be reduced from past levels. New roads into watersheds that are currently unroaded or have very few roads will be rare. New roads into such areas could occur following analysis that demonstrates that access is needed to prevent or address imminent environmental damage or provide for valid existing rights.

Generally, most issues surrounding road condition, risk, and management opportunity for restoration are expected to be more significant on forested lands than on rangelands.

Science-based roads analysis has been developed to provide the tool to systematically and objectively evaluate road networks and help distinguish variability in road condition and risk. Roads analysis provides an ecological approach to transportation

planning, addressing existing roads and future roads including those planned in unroaded areas. Roads analysis is intended to be the systematic, consistent, and integrated approach to transportation planning. ICBEMP road management direction incorporates use of roads analysis and Subbasin Review to provide information and context needed to effectively and efficiently reduce road-related adverse effects. Results of roads analysis is aimed at producing information and maps that will display management opportunities and risks of existing roads to better address future needs, budgets, and environmental concerns. Roads analysis is expected to provide the foundation for road-related decisions and facilitate development of transportation plans such as Access and Travel Management plans and other NEPA documents. Decisions on individual roads would be made at the local level, based on appropriate analysis and collaboration. Collaboration would include interested parties such as affected tribes, state and local government, and any state-established road councils.

The overarching intent for roads management within the ICBEMP is to progress toward a smaller transportation system that can be maintained into the future with minimal environmental impact. In recognizing that this intent cannot be met instantaneously, the direction intends for the use of a staged approach that concentrates short-term efforts on reducing road-related adverse effects, while determining the long-term road system needs and locations in a manner that maintains choices for future generations. Road management guidance in existing plans such as the Grizzly Bear Recovery Plan and newer land use plans already moves in this direction. The biggest change to the existing road system is expected in areas that are highly roaded and have high road-related risks to resource values, where action has not already been taken to address the problem.

Roads Analysis

B-O23. Objective. Determine the long-term road system that supports natural resource objectives and provides access to public lands while minimizing road-related risks and adverse effects from existing and future planned roads.

Rationale: The road system on federally administered lands is extensive and needs to be reconfigured. The intent of implementing roads direction is to have fewer miles of roads and to have these roads be of low impact in low-risk locations.

B-O24. Objective. Use existing information during Subbasin Review and EAWS to characterize those landscape elements that contribute to or influence the hazards and risks associated with roads across the subbasin, to provide context and facilitate prioritization for subsequent finer scale roads analysis.

Rationale: Subbasin Review can provide a broad discrimination of hazard and risk by identifying general relationships among hazards to aquatic and terrestrial systems and elements such as geology, slope position and angle, precipitation, drainage density, and intensity of road networks. This information can provide context and identify priorities and the appropriate geographic extent for subsequent roads analysis. Subbasin Review is not intended to provide detailed road maps or information but would rely more on GIS and physiographic information to help interpret detailed information. The draft Subbasin Review Guide provides guidance regarding characterization and prioritization of risks and opportunities for this mid-scale analysis.

B-S22. Standard. Roads analysis shall be incorporated into or conducted concurrently with watershed-scale analysis, such as EAWS, the analyses produced in compliance with the 303D protocol that may result in a water quality restoration plan, and/or site-specific project analysis.

Rationale: Roads analysis is the tool to assist land managers in balancing road systems objectives and provides the context and information needed for assessing tradeoffs and risk prior to decision-making. It is intended to be flexible and driven by road-related issues important to the public and to managers. It promotes a multi-scale approach to assure that these issues are examined in context. The process provides a set of analytical questions as guidance that can be used to tailor analysis techniques to individual situations. The questions address road relationships to aquatic and riparian resources, water quality, terrestrial wildlife, ecosystem function, economics, commodity production, access, minerals, range, recreation, and other resources.

The products from roads analysis would have a differing form depending on scale. The objectives of roads analysis *at the watershed scale* are: (1) to provide context for site level design and (2) refine information about risks and hazards based on the description of populations of landscape elements (such as locations, magnitudes, and frequencies). The objective of roads analysis *at the site-specific project scale* is to systematically collect information with regard to pending risks and hazards from existing and future roads to: (1) identify potential resource problems (channel elongation, generation of mass wasting, migration barriers); and (2) determine potential short- and long-term effects on values at risk (aquatic species and other beneficial uses), to provide an adequate evalua-

tion for design and implementation of proposed activities. Field level inventory is expected prior to implementing road restoration or other road related activities. In some cases field level information may be desirable to address road risk and complete data gaps identified through roads analyses conducted at the watershed scale.

B-S23. Standard. When conducting roads analysis, consult federally recognized tribes to address access to treaty resources and culturally significant areas.

B-O25. Objective. New road building should rarely occur in watersheds that are currently unroaded or have very few roads. New roads into these areas could occur following roads analysis and/or NEPA analysis that considers the larger watershed context. These analyses should weigh the relative habitat values of species potentially affected by roads, such as anadromous fish and wide-ranging carnivores, against the need to address large-scale environmental damage or public safety. See also management direction for A1 and A2 aquatic subwatersheds regarding new road building.

B-G29. Guideline. In watersheds that have few or no roads and where there is a high risk to resource values from uncharacteristic fires, consider using existing roads and other methods of transportation to manage fuels.

Access and Travel Management Plans

B-O26. Objective. In the development or revision of Access and Travel Management Plans, ensure the public (including appropriate state, county, and tribal entities) is involved and that access to public lands is retained to the extent possible consistent with maintaining or achieving objectives and standards designed to address terrestrial, wildlife, aquatic, and riparian issues.

Rationale: While roads have been shown to be detrimental to terrestrial, aquatic, and riparian resources, they also represent a substantial investment in transportation capability that generates very high use values for the public, existing rights of way, and access value to land management agencies. A major cause of terrestrial species mortality, disturbance, and habitat loss is related directly to human access. Stresses caused by access to wintering areas also have been demonstrated to cause problems for a number of species. These adverse effects would be reduced by implementation of actions to reduce the risk of wildlife displacement and mortality associated with human access (such as location and timing of seasonal and permanent closures) through road management decisions in Access and Travel Management Plans or other transportation plans.

B-S24. Standard. Access and Travel Management Plans or other transportation plans shall be developed or revised within the next 10 years to address risks identified in the roads analysis. These plans shall identify long-term transportation needs (including needs for public access) and road maintenance practices.

Rationale: The intent of this standard is that decisions on management of roads should be made at the local level with involvement from interested and affected parties (including local, county, and tribal entities) through the local Access and Travel Management Plan processes.

Road Construction and Reconstruction

B-O27. Objective. To ensure attainment of aquatic, terrestrial, and riparian objectives, prevent or minimize adverse effects from road and landing construction and reconstruction.

B-S25. Standard. New roads and other transportation facilities should be located outside of RCAs unless effects of other alternatives are greater to aquatic, riparian, water quality, and/or terrestrial resources, as supported/determined by the appropriate analysis and decision-making process, including, as appropriate, ESA consultation. When crossing RCAs with roads, appropriate measures shall be used to mitigate adverse effects.

Rationale: Roads create numerous negative effects within riparian areas including sedimentation, habitat destruction, and increased human use. The intent of this standard is to prevent and reverse these adverse effects. However, it is recognized that at times it will be preferable to cross an RCA with a road rather than affect upland areas by building a more damaging road in order to avoid a stream crossing.

B-S26. Standard. Construction of new and reconstruction of existing road crossings of streams and rivers that currently or historically supported native fish species shall maintain and restore fish passage, fish spawning, and channel stability unless passage would allow undesirable non-native fish distribution expansion that would result in adverse interactions with native fish.

B-O28. Objective. Avoid disruption of hydrologic flow paths and processes by locating, designing, and

Definitions

The *12 **"families"*** represent aggregates of 91 broad-based terrestrial vertebrate "species of focus." These 91 species were placed into 40 groups based on their source habitat uses. The groups were later combined into the 12 Terrestrial Families, again based on habitat requirements. The original 91 species were selected based on whether: (a) their habitats might require further assessment and management at broad spatial scales within the basin, (b) their population size is known or suspected to be declining (could be related to habitat decline or not), and (c) their habitats can be estimated reliably using a large mapping unit (247 acres or 100 hectares) and broad-scale methods of spatial analysis. Habitats of five of those Families have been determined by Wisdom et al. (in press) to be most in decline compared to historical levels (see Terrestrial Families 1, 2, 4, 11, and 12 box on the following page).

Source habitats are those characteristics of vegetation that support long-term species persistence; characteristics of vegetation that contribute to stable or positive population growth for a species in a specified area and time. These source habitats are described using the dominant vegetation cover type and the structural stage. There are 157 cover type and structural stage combinations in the ICBEMP that can be estimated reliably at the 247-acre (100-hectare) patch scale. Various combinations of these cover type–structural stages make up the source habitats for the 12 Terrestrial Families, and provide the range of vegetation conditions required by these species for food, reproduction, and other needs.

— from *Source Habitats for Terrestrial Vertebrates* (Wisdom et al. in press).

conducting road construction and reconstruction to avoid unstable and potentially unstable lands.

Terrestrial Source Habitats

Description and Management Intent

The objectives, standards, and guidelines in this section are aimed at changing declining trends in terrestrial habitats in base level areas (all lands administered by the Forest Service or BLM in the project area). The intent of this section is to maintain many of the important vegetation characteristics, such as species composition, vegetation structure, snags, and coarse woody debris, which various terrestrial species need so they can survive and reproduce.

Direction is intended to be applied to source habitats for 12 aggregates of terrestrial birds, mammals, and reptiles called "families" in *Source Habitats for Terrestrial Vertebrates* (Widsom et al. in press), unless otherwise specified. Source habitats are those characteristics of vegetation that contribute to a species' population maintenance or growth over time and within an area. These source habitats are described using the dominant vegetation cover type and the structural stage, various combinations of which make up the source habitats for the 12 Terrestrial Families and provide the range of vegetation conditions required by these species for cover, food, reproduction, and other needs. Terrestrial Families 1, 2, 3, and 4 depend mostly on forested source habitats; Terrestrial Families 10, 11, and 12 use mostly rangeland source habitats; and Terrestrial Families 5, 6, 7, 8, and 9 are associated with a combination of forest and rangeland source habitats. The habitats of species affiliated with Terrestrial Families 1, 2, 4, 11, and 12 have been determined by Wisdom et al. (in press) to be have declined in geographic extent most substantially from historical to current periods within most RAC/PAC areas (see Terrestrial Families 1, 2, 4, 11, and 12 box).

The management intent is also to preserve options for these source habitats in the short term so they can possibly be restored in the long term. This fits into the overall risk management strategy to conserve and expand, in the short term, the source habitats that have shown the greatest decline. The long-term goal is to have a sustainable mix of habitats that are patterned to be consistent with the landform, climate, biological, and physical characteristics of the ecosystem, and that provide for a network of source habitats to meet terrestrial species needs.

Forest Composition and Structure

B-O29. Objective. Increase the abundance of shade-intolerant species such as western white pine, ponderosa pine, and western larch in the moist and dry forest potential vegetation groups (PVGs), and whitebark pine in the cold forest PVG. Increase the extent of these species in pure stands, and in mixed

Terrestrial Families 1, 2, 4, 11, and 12

Terrestrial Families 1, 2, 4, 11, and 12 represent groups of species associated with habitats that have been determined by Wisdom et al. (in press) to have declined substantially in geographic extent in the project area compared to historical amounts. The five families, source habitats, and associated species are:

1. Terrestrial Family 1 (old forest, low elevation source habitat) includes white-headed woodpecker, white-breasted nuthatch, pygmy nuthatch, Lewis woodpecker (migrant population), and western gray squirrel.
2. Terrestrial Family 2 (old forest, broad elevation source habitat) includes blue grouse (winter), northern goshawk (summer), flammulated owl, American marten, fisher, Vaux's swift, Williamson's sapsucker, pileated woodpecker, Hammond's flycatcher, chestnut-backed chickadee, brown creeper, winter wren, golden-crowned kinglet, varied thrush, silver-haired bat, hoary bat, boreal owl, great gray owl, black-backed woodpecker, olive-sided flycatcher, three-toed woodpecker, white-winged crossbill, woodland caribou, and northern flying squirrel.
3. Terrestrial Family 4 (early seral forest source habitat) includes the lazuli bunting.
4. Terrestrial Family 11 (sagebrush source habitat) includes sage grouse (summer), sage grouse (winter), sage thrasher, Brewer's sparrow, sage sparrow, lark bunting, pygmy rabbit, sagebrush vole, black-throated sparrow, kit fox, and loggerhead shrike.
5. Terrestrial Family 12 (grassland and open-canopied sagebrush source habitat) includes Columbian sharp-tailed grouse (summer), clay-colored sparrow, grasshopper sparrow, and Idaho ground squirrel.

stands where it is ecologically appropriate. Favor retention of emergent large trees, especially in roaded and/or harvested areas. Create stands with stocking levels and fuel loads that are more resilient to wildfire, insects, and disease. Blister-rust-resistant western white pine and whitebark pine planting stock should be used when possible.

Rationale: In some areas in the dry forest PVG, ponderosa pine is not endemic (native to a certain region), and Douglas-fir fills its niche as the shade-intolerant species. In these areas, it is desirable to restore or increase the abundance of Douglas-fir in patches that are consistent with the landform, climate, biological, and physical characteristics of the ecosystem.

Shade-intolerant species are important from an ecological perspective because they are resilient to the predominant fire regime. To prevent further declines of forest ecosystem processes and functions, timber harvest should be done for stewardship reasons and be consistent with ICBEMP objectives such as: reducing risk of severe fire behavior, reducing risk of severe fire effects, promoting shade-intolerant tree species, promoting scarce terrestrial habitats, and increasing the forest's resiliency to disturbance. Clearcutting is appropriate when done for ecological reasons such as the need to regenerate species (for example western white pine and western larch) or to meet other objectives such as creating scarce habitat.

Scattered snags or emergent trees are important to many wildlife species that use forest stand-initiation structural stages. *Emergent trees* are those with crowns reaching above the predominant crown layer, providing structural diversity. Large trees are also important to many wildlife species, and adaptation of these trees to frequent low intensity fire regimes has important ecological ramifications. The size of a "large tree" is relative; it depends on species, structural stage, predominant disturbance regime, and site productivity.

B-S27. Standard. Maintain and/or restore large shade-intolerant trees and snags in densities that are consistent with the range of historical conditions. Large shade-intolerant trees and snags, especially ponderosa pine and western larch, should be retained where they are needed to meet historical levels and if their retention does not violate safety standards or preclude attainment of overall resource objectives.

Rationale: Large trees is a relative term dependent on species and site. Large trees are a future source of large snags, and large snags are a future source of coarse woody debris, another important habitat component for many species. It is important to have present and future sources of large trees and snags at adequate levels though time. Larger snags are generally better than smaller snags because they exist longer. Large trees and/or snags are essential habitat

components for many species in Terrestrial Families 1, 2, 7, 8, and 9 (Wisdom et al. in press).

B-G30. Guideline. Management tools such as thinning and prescribed fire may be used to make forests dominated by shade-intolerant species more resilient to fire, insects, and disease. Favor large trees by giving them growing space on at least two or three sides and removing nearby fuel ladders.

B-G31. Guideline. Seedtree or group selection methods may be used to regenerate western white pine where seed sources exist, and large openings can be created in the forest for planting. Scattered large residual trees and snags could be left in these openings to make them more valuable to wildlife species that depend on these habitat features.

B-G32. Guideline. Prescribed and managed wildland fire may be used to assist regeneration in healthy whitebark pine stands. Where the stand is infested with blister rust, blister-rust-resistant planting stock could be used if available.

B-G33. Guideline. Look for opportunities to use natural regeneration where the species, seed source, seedbed, and moisture conditions are all favorable. Rely on natural regeneration following stand-replacing wildfire if a seed source of the desired species exists.

Rationale: Shade-tolerant trees in forests that have regenerated from natural seeding have adapted to site conditions and local climate over thousands of years. The genetics to perpetuate those characteristics are found in the seeds produced by the shade-tolerant trees. If that seed source is lost, so is its genetic diversity.

Achieving successful natural regeneration requires that: the overstory trees of the desired species are capable of producing viable seed, a mineral soil seedbed is available for germination, there is adequate water and lack of competition to allow the seedlings to survive, and there is enough light to allow the seedlings to carry on photosynthesis and grow.

B-G34. Guideline. Consider controlling livestock grazing in forests where planted or naturally regenerated seedlings are vulnerable to browsing or trampling.

Rationale: Although livestock grazing can have beneficial effects on tree seedlings through reductions in vegetation competition, germinants and small seedlings are often trampled and/or browsed by livestock. The result is that trees and important native herbs and shrubs can be killed, and growth can be slowed or misshapen. Terrestrial vertebrates that depend on the stand-initiation stage of forest development depend on a rich supply of native herbs and shrubs for nesting and foraging. Livestock grazing can reduce the availability of these resources.

B-G35. Guideline. Use a combination of harvesting, mechanical treatments, and/or prescribed fire to modify forest composition to dominance by shade-intolerant species (such as ponderosa pine, western larch, Douglas-fir).

B-G36. Guideline. Where true firs are infected, consider reducing susceptibility of stands to annosus root disease by: lowering the number of entries into stands, shortening rotations, decreasing wounding during harvest, or manipulating species mixtures by changing to ponderosa pine, western larch, or Douglas-fir.

B-G37. Guideline. Consider reducing the susceptibility of stands to laminated root rot by avoiding shelterwood cuts which favor regeneration of susceptible shade-tolerant species or by switching to species that are more resistant to root rot, such as western redcedar, pines, and larch, where appropriate.

B-G38. Guideline. Consider reducing the susceptibility of stands to Armillaria root disease by: using thinning, harvesting, and/or prescribed fire to increase vigor; pre-commercial thinning sites of moderately low productivity that are infected; or planting shade-intolerant species such as larch, pine, and hardwoods in infected areas. Minimize subsequent entry in moist forest PVG stands.

B-G39. Guideline. Consider removing root-disease-infected stumps after thinning or harvest to prevent the infection of future stands on highly productive sites. Minimize soil damage and reforest with early successional species that are most likely to tolerate the pathogen and soil damage.

B-O30. Objective. [Terrestrial Families 1 & 2] *In the short term*, maintain and prevent loss of old forest in dry and moist forest potential vegetation groups (PVGs). Maintain old forest patch sizes consistent with the landform, climate, and biological and physical conditions of the ecosystem. Identify single story and multi-story old forest stands in the interior ponderosa pine, Pacific ponderosa pine, and Sierra Nevada mixed conifer cover types; and multi-story old forest stands in the Douglas-fir, western larch, western white pine, aspen, and cottonwood-willow cover types. Take steps to prevent the loss of this relatively scarce habitat from natural or human-caused disturbances. Actively manage to promote

their long-term sustainability and to preclude uncharacteristically severe wildfire through activities such as prescribed fire, stewardship thinning, and/or other vegetation/biomass management techniques.

Because the determination of old forest depends on regional location within the project area (such as climate and geology), tree species, and site productivity (such as soils, aspect, slope, water), and because old forest is defined using a number of variables (see Rationale, below), BLM and Forest Service managers should determine old forests using minimum characteristics developed by Green et al. (1992) for lands within the Forest Service Northern Region (Idaho north of the Salmon River and Montana), Hamilton (1993) for lands in the Intermountain Region (Idaho south of the Salmon River), and USDA Forest Service (1993) for lands in the Pacific Northwest Region (Washington and Oregon).

Promote emergent and large trees, snags, and coarse woody debris levels that can be sustained through repeated prescribed fire activities that will be needed to restore and maintain the stands. Use appropriate vegetation management techniques to protect large trees from disturbances (such as fire, insects, or disease) which could convert old forests to an early or mid seral stage.

Rationale: Old forest is defined primarily using such variables as: (1) number of trees per acre of a minimum diameter at breast height (DBH), (2) minimum stand age, (3) basal area, (4) tree decadence, (5) snag levels, (6) downed wood levels, and some other variables. The result is that the characteristics of old forest will be different between different forests, for example, between ponderosa pine and lodgepole pine forests. See Appendix 17a and 17b for definitions of old forest as established by each of the three Forest service regions (Northern, Intermountain, and Pacific Northwest) that make up the ICBMEP project area. These three sets of criteria for old-growth ecosystems will be used as guidance by Forest Service and BLM personnel at the forest, district, and field office levels during implementation of the ICBEMP management direction.

Overall, the project area has shown a great reduction in single story and multi-story old ponderosa pine forest as well as other old forest types from historical to current periods (Hann, Jones, Karl, et al. 1997, Wisdom et al. in press). Terrestrial species dependent on these habitats have been pushed to use other structural stages in cover types that have expanded over the same time interval—for example, multi-story interior Douglas-fir. Therefore, even though we recognize that some multi-story interior Douglas-fir forests currently exist where they did not grow historically, they should be perpetuated in the short term or longer to minimize the risk to the terrestrial species that depend on these forests. Managing short-term risk to these species is part of the terrestrial strategy.

In the short term, land managers should strive to promote old forest conditions and protect old forests from both natural and human-caused disturbances (such as harvest and wildfire) because old forests and their associated species are in such short supply. As the amount of old forest on the landscape increases through time to desired levels consistent with natural disturbance regimes, the locations of old forest can begin to change over time. Further, amounts of old forest can vary over time within desired limits, as some patches of old forest are burned, harvested, or otherwise disturbed while some patches of mid-seral forest mature, developing old forest conditions. *In the long term*, the location of old forest patches is not static; areas move in and out of having old forest characteristics, especially in cold and moist forest PVGs where a high proportion of the fire regime consists of stand-replacing fire. *Emergent trees* are those with crowns reaching above the predominant crown layer, providing structural diversity.

Preventing the loss of old forest might include a "wildland fire use for resource benefit" program, prescribed fire program, removal of ladder fuels and smaller competing trees, a program of wildfire suppression, and conversion of some multi-story to single story structure.

Old forest aspen is an important cover type for terrestrial species. However, when aspen stands become decadent, they tend to lose their ability to regenerate well. Therefore, maintaining aspen on the landscape requires a cyclical and timely disturbance so that it can be regenerated before it gets too old to be sustained.

Snags, Coarse Woody Debris

B-O31. Objective. Maintain and/or recruit adequate numbers, species, and sizes of snags and levels of downed wood to meet the needs of wildlife, invertebrates, fungi, bryophytes, saprophytes, lichens, other organisms, long-term soil productivity, nutrient cycling, carbon cycles, and other ecosystem processes. Consider the natural variability in number and size of snags and downed logs across landscapes, through time, and in the context of biomass levels under which soils and species evolved. Manage for snag species appropriate to the site.

Rationale: Snags and downed logs are important components of forest and woodland ecosystems. They provide essential habitat for wildlife, invertebrates, fungi, bryophytes, saprophytes (plants that derive nourishment from dead or decaying organic matter), lichens, and other organisms. They store carbon and nutrients and provide site improvement following extreme disturbance. Snags and coarse woody debris are closely tied, because snags are a future sources of downed logs and coarse woody debris, which recycle nutrients and provide habitat for both plants and animals. Large diameter snags are especially valuable to a wide array of species because they offer greater surface area, more opportunity for cavities, and greater longevity. Hann, Jones, Karl, et al. (1997) found that snag and coarse woody debris levels have declined in roaded and harvested areas. Providing for the appropriate species of snags in a stand, in addition to the appropriate numbers and sizes of snags, is necessary to maintain the value of the stand for wildlife. Shade-intolerant snag species have declined substantially in geographic extent from historical to current periods and are key to providing for species in Terrestrial Families 1 and 2.

Snags usually are not distributed evenly on a natural landscape. The number and pattern of snags should vary across the landscape based on site classification (potential vegetation type), successional stage, and disturbance history. In general, more productive sites such as north slopes, moist sites, and riparian areas should support more snags; the least productive sites should support the fewest snags. Very early successional stages, soon after a disturbance, should have highest number of snags on site, followed by late seral stages. Because many wildlife species find groups of snags more useful than evenly distributed snags on the landscape, there should be groups as well as single snags.

Coarse woody debris is important to a wide variety of wildlife species, invertebrates, and microorganisms as habitat and food source. In addition, coarse wood is essential to long-term soil productivity and several ecosystem processes. It provides soils with a source of carbon and nutrients, and sometimes provides a reservoir for water. Size and amount of coarse woody debris cannot be expected to be evenly distributed across landscapes. It varies with topographical features, climate, slope, aspect, habitat type, successional stage, management practices, and many other factors. Amount of coarse woody debris is an important factor in wildland fire intensity and severity, so levels are intended to be consistent with the predominant fire regime and prescribed fire objectives.

B-S28. Standard. Maintain and/or recruit snag and coarse woody debris numbers, species, and sizes within the desired range for a RAC/PAC area as established in Standard B-S29(S2) and B-S29(S3) or for a watershed through the process in Standard B-S30(S2). If it is not possible to estimate snag numbers or coarse woody debris levels within a watershed, then leave or recruit the number of snags and levels of coarse woody debris indicated by the desired range. If current snag numbers or coarse woody debris levels are estimated to be less than the desired range for a watershed, then leave or recruit appropriate amounts of snags and coarse woody debris to move toward the established range.

Rationale: When estimates show that current numbers and sizes of snags or levels of coarse woody debris in a watershed are above or below the desired range, based on use of a process described in standard B-S30(S2) or on the tables from standard B-S29(S2) and B-S29(S3), there is an opportunity to move toward the desired range (1) whenever vegetation management activities are undertaken, and (2) as a separate restoration activity aimed at restoring old forest structure in watersheds where EAWS indicates that stands with old forest characteristics are below desired levels. The needed precision of the estimates varies with the scale of the analysis, with less precise estimates needed for an EAWS than for site-specific NEPA analysis.

B-S29(S2). Standard *for Alternative S2 Only. Prior to completing the process described in standard B-S30(S2),* the tables in Appendix 12 shall be used to determine snag numbers and coarse woody debris levels whenever vegetation management is done.

Rationale: The tables in Appendix 12 were developed to assure that appropriate numbers of snags and levels of coarse woody debris would be maintained while standards that are more appropriate for local conditions are developed or verified.

B-S29(S3). Standard *for Alternative S3 Only.* The tables in Appendix 12 shall be used to determine snag numbers and coarse woody debris levels whenever vegetation management is done.

Rationale: The tables in Appendix 12 were developed to assure that appropriate numbers of snags and levels of coarse woody debris would be maintained. In Alternative S3, locally appro-

priate snag numbers and coarse woody debris levels may be developed or verified, but it is not required.

B-S30(S2). Standard ***for Alternative S2 Only*** **(no parallel standard for Alternative S3).** Within five years, administrative units or groups of units (national forests/BLM districts) shall modify default numbers shown on the tables in Appendix 12 to determine (1) numbers and sizes of snags and (2) coarse woody debris levels appropriate for local conditions. In making these determinations, units shall use the snag analysis and coarse woody debris processes described in Appendix 12, or they shall use or develop a similar process appropriate for local conditions. If local units use or develop a new process, it must have a scientific basis, using information from the literature and/or studies on historical conditions to determine snag sizes and average numbers. When using any of these processes, administrative units shall collaborate with appropriate agencies, governments, or groups so that this standard is applied consistently. If administrative units currently have standards that were developed using a process they believe meets the intent of this standard, then they need only verify its basis on current science to continue its use.

Rationale for Alternative S2: This standard assures that all administrative units will have snag and coarse woody debris standards appropriate for local conditions within five years.

Rationale for Alternative S3: Under Alternative S3, the tables in Appendix 12 would be used to determine snag numbers and coarse woody debris levels. The direction to develop a process appropriate for local conditions would not be required.

B-G40. Guideline. Consider leaving or recruiting additional snag numbers and coarse woody debris levels in areas that have been burned.

B-G41. Guideline. Consider estimating large snag densities as part of EAWS. Where densities are below the established, desired ranges, initiate management activities to increase snag levels through snag recruitment.

Rangelands Composition and Structure

B-O32. Objective. Maintain upland rangelands in proper functioning condition by addressing the biological needs as indicated by vegetation composition, diversity, structure, cover, vigor, and recruitment, and the physical needs as indicated by erosional flow patterns, soil movement, litter, soil crusting, and compaction.

Rationale: Proper functioning condition of upland rangelands is reached when the biological and physical components display the characteristics of a dynamic, diverse, healthy ecosytem that is able to withstand natural disturbance events. Once the components are in place then the mix of plant species composition and structural characteristics (seral conditions) can be managed to meet various ICBEMP objectives.

B-O33. Objective. [Terrestrial Families 11 &12] Manage species composition (diversity), structure and age class, cover, density, and surface litter on native rangeland plant communities, appropriate to soil type, climate and landform, to maintain the following source habitats (rangeland cover types): big sagebrush, low sagebrush, mountain big sagebrush, salt desert shrub, fescue-bunchgrass, wheatgrass-bunchgrass, and antelope bitterbrush-bluebunch wheatgrass.

Rationale: One of the biggest tasks for land management agencies is the maintenance of existing native rangeland communities in healthy condition. With natural and human-caused disturbances, the task of rangeland health maintenance is difficult. Providing the historical mix of species composition, structure, and cover is paramount to meeting source habitat needs for the many terrestrial species that rely on rangelands during all or part of their life cycle.

B-O34. Objective: Rangelands seeded with mixtures should function to maintain life form diversity, forage production, native animal habitat, nutrient cycling, energy flow, and hydrologic cycle.

Rationale: Rangeland seedings have been used to take livestock grazing pressure off the native rangelands in some grazing systems. In serving this purpose some rangeland seedings are managed mainly for forage production for livestock and not for the composition and structural habitat needs of terrestrial species. This objective recognizes that these seedings also should provide habitat for terrestrial species and must maintain the characteristics of healthy source habitats.

B-O35. Objective: At a minimum, rangeland seedings should function to maintain forage production, nutrient cycling, energy flow, and the hydrologic cycle.

Rationale: Some seedings, such as older crested wheatgrass seedings, are essentially monocultures specifically used for forage production. This standard recognizes that even these seedings must meet certain mini-mum functional and process needs to meet overall ecosystem health at larger scales.

B-O36. Objective: Exotic plant communities, other than seedings, should meet minimum requirements of soil stability and maintenance of existing native plants. These plant communities should be rehabilitated to perennial communities of diverse composition and structure when feasible, cost-effective methods are developed.

Rationale: It is the intent of this objective to rehabilitate exotic plant communities, such as cheatgrass, back to the perennial plant communities that occupied these sites prior to human disturbances. However, it is realized that this task is easier said than done, because poor soils and low precipitation make rehabilitation difficult or impossible to do at this time. Until technology and cost-effective measures become a reality, exotic plant communities should be managed to provide basic soil stability needs and to protect remnant perennial plant species.

Aquatic/Riparian/Hydrologic Component

Description and Management Intent: Overall

The overall intent of base level aquatic/riparian/hydrologic direction is to prevent degradation to and improve conditions of aquatic and riparian habitat. This should provide habitat conditions on Forest Service- and BLM-administered lands to sustain aquatic and terrestrial species and provide water of sufficient quality to support beneficial uses.

In the base level section, management objectives and standards are provided for riparian conservation areas (RCAs), riparian influence areas, watershed condition indicators, and water quality. Additional base level direction for aquatic/riparian/hydrologic resources is found in the Landscape Dynamics and Terrestrial and Aquatic Species sections. Additional direction for A1 and A2 subwatersheds and aquatic and hydrologic restoration follows later in this chapter.

Riparian Conservation Areas (RCAs)

Description and Management Intent

The primary management emphasis of riparian conservation areas (RCAs) is to maintain, conserve (protect), and/or restore aquatic and riparian-dependent terrestrial resources. Proper ecological function in RCAs is crucial to maintaining aquatic ecosystems and riparian-dependent resources. RCAs are intended to do the following:

a. Help maintain and restore riparian structures and functions;
b. Benefit fish and riparian-dependent resources;
c. Enhance conservation of organisms dependent on the transition zone between upslope and the stream; and
d. Improve connectivity of travel and dispersal corridors for terrestrial animals and plants, and aquatic organisms.

Definitions

A **riparian ecosystem** is an area that is a transition between terrestrial and aquatic ecosystems. It includes streams, lakes, wetlands, and adjacent vegetation communities and their associated soils which have free water at or near the surface and whose components are directly or indirectly attributed to the influence of water. Riparian areas provide valuable habitat for many non-vascular plants, vertebrates, and invertebrates.

Riparian conservation areas (RCAs) are delineated areas that encompass riparian ecosystems. Management activities in RCAs will be governed by ICBEMP objectives and standards when the ROD is signed.

Management activities (such as silvicultural treatments, livestock grazing, and road construction) within or affecting RCAs that would not maintain existing conditions or lead to improved conditions would not meet the intent of ICBEMP standards and objectives. These activities either would not be implemented or would be modified.

The management focus is to achieve ICBEMP objectives over the long term. The intent also is to avoid short-term impacts that reduce the riparian area's ability to achieve objectives over the long term. It is recognized that some short-term impacts may occur from activities that are deemed desirable and consistent with objectives (for example, road maintenance, culvert replacement); however, all short-term risks are not categorically acceptable. The decision to take short-term risks must be made, to the extent possible, within the context of information generated through the step-down process. For example, when Subbasin Review and EAWS are completed prior to designing site-specific activities, the knowledge gained should enhance understanding of risks at various scales and provide a broader context and stronger informational support for management activities that carry short-term risk. However, it is recognized that this larger-scale information context may not always be available.

RCA Management Direction

The following objectives and standards apply to management activities and land uses within riparian conservation areas on Forest Service- or BLM-administered land. The objectives were designed, as noted earlier, to be assessed at a watershed or larger scale and not at a site scale. However, in the absence of subbasin and/or watershed scale context, projects will need to be evaluated as to their consistency with and contribution to these objectives within the limited context of the project. In the absence of subbasin and/or watershed scale context, the project has to be evaluated against the objectives in isolation. This should neither stop emergency actions that would attain management objectives, nor impede restoration actions that need to occur (such as road obliteration or culvert replacement). Short-term risks may be taken in these circumstances, but these actions should not prevent attainment of objectives over the long term. The ideal situation is Subbasin Review and/or EAWS preceding the design of management activities within RCAs. This facilitates a risk management strategy that would allow site-specific NEPA analysis to evaluate consistency with objectives within a large context. This larger context for risk assessment would help identify temporal (short-term and long-term) and spatial (placement on the ground) opportunities to enhance conservation and restoration and where short-term risks may be taken to achieve long-term management objectives.

B-O37. Objective. Maintain and improve physical integrity of aquatic ecosystems, including shorelines, banks, and bottom configurations.

B-O38. Objective. Maintain and improve riparian and wetland vegetation to:

a. Provide an amount and distribution of woody debris sufficient to sustain physical and biological complexity characteristic of natural aquatic and riparian ecosystems;
b. Provide adequate summer and winter thermal regulation within riparian and aquatic zones;
c. Help achieve rates of surface erosion, bank erosion, and channel migration characteristic of those under which plant communities developed; and
d. Provide appropriate amounts and distributions of source habitats for riparian- or wetland-dependent species.

Rationale: Adequate amounts of healthy riparian and wetland vegetation are critical to functioning aquatic, riparian and wetland systems, which are necessary for riparian- and wetland-dependent species (listed in Appendix 6.) Some examples of cover types and structural stages important to riparian species are: cottonwood-willow/stand-initiation, shrub wetlands/open herbland, shrub wetlands/closed herbland, shrub wetland/open low-medium shrub, and shrub wetland/closed tall shrub. Some important environmental conditions related to riparian-dependent species include: maintenance and recruitment of large snags (see objective B-O31), mitigation of roads and road-associated effects (see standards B-S31 to B-S34), mitigation of human-associated activities (see objective B-O48), mitigation of livestock and associated impacts on native understory vegetation (see standards B-S31 and B-S32), restoration of hydrologic conditions to support large cottonwood/willow tree habitat (see objective B-O8), and restoration of riparian vegetation communities, such as riparian shrubs (see objective R-O24).

Past alterations to vegetation on Forest Service- and BLM-administered lands within the project area have resulted in riparian habitat conditions that are less than optimal for aquatic and riparian-dependent

species. Although the broad-scale data used for the ICBEMP are not detailed enough to quantify changes in riparian and wetland vegetation from historical to current, it is known that riparian ecosystem function, determined by the amount and type of vegetation cover, has decreased in most subbasins.

The intent of this objective is to ensure that adequate amounts of riparian and wetland vegetation are sustained or increased in the long term, basin-wide, and that further habitat degradation does not occur. In order to determine appropriate amounts of habitat, it may be necessary to assess riparian and wetland habitat and species requirements, comparing current to potential conditions. This determination should be made during EAWS or site-specific NEPA analysis.

B-S31. Standard. New management activities (subject to valid existing rights; see standard B-S34) within or affecting RCAs shall be conducted only if they are consistent with the RCA management objectives of maintaining or improving banks, shorelines, bottom configurations, amount and distribution of woody debris, thermal regulation, characteristic erosion rates, and amount and distribution of source habitats.

Watershed Condition Indicators (WCIs) shall be used to evaluate proposed activities and determine consistency with RCA management objectives. See the management intent and direction for WCIs for further detail.

Rationale: New management activities include those actions which require NEPA decision documents. Activities include, but are not limited to, hydropower projects, silvicultural practices, road and trail construction, fuel storage, herbicide and pesticide application, and recreation facilities.

B-G42. Guideline. NEPA planning and decision documents for projects within riparian conservation areas could specify best management practices (BMPs) required to maintain or achieve the objectives, and could include a discussion of the anticipated effectiveness of the BMPs.

B-S32. Standard. Existing land uses, facilities, and actions within or affecting RCAs shall be modified, discontinued, or relocated if they are not maintaining or improving banks, shorelines, bottom configurations, amount and distribution of woody debris, thermal regulation, characteristic erosion rates, and amount and distribution of source habitats (subject to valid existing rights).

Watershed Condition Indicators (WCIs) shall be used to evaluate existing land uses, facilities, and actions within or affecting RCAs and determine consistency with RCA management objectives. See the management intent and direction for WCIs for further detail.

Rationale: Existing land uses, facilities, and actions include but are not limited to: livestock grazing, existing dispersed and developed recreation facilities and practices, and road and trail maintenance, including sidecasting.

B-S33. Standard. During licensing or relicensing of hydroelectric projects, terms and conditions that achieve aquatic and RCA management objectives over the new license term shall be submitted to the Federal Energy Regulatory Commission.

Rationale: See Section 4[e] of the Federal Power Act for a description of the Forest Service and BLM's authority and responsibility to provide terms and conditions to FERC. Relicensing of hydropower projects should be consistent with this standard so long as on- and off-site mitigation, restoration, and enhancement are conducted to meet RCA management objectives.

B-S34. Standard. For those management activities conducted persuant to valid existing rights that may pose risks to achievement of RCA management objectives, existing authorities shall be used to mitigate and/or require to the extent authorized design features that would contribute to the maintenance of banks, shorelines, bottom configurations, amount and distribution of woody debris, thermal regulation, characteristic erosion rates, and amount and distribution of source habitats.

Rationale: Land management agencies have limited authority to preclude certain activities (such as mining) in priority areas. However, they do have authority to require reasonable terms and conditions or mitigation measures to minimize the effects of some of these uses. Standard B-S34 requires the use of existing authorities to minimize the impacts of certain uses, over which the BLM and Forest Service have limited authority.

B-S35. Standard. Management activities and land uses in RCAs shall be implemented to attain proper functioning condition (BLM Technical Report 1737-9 [USDI/BLM 1993] and 1737-11 [USDI/BLM 1994]) as a first step to move habitat conditions of streams, riparian areas, or lakes and ponds toward achieving aquatic and RCA management objectives.

Rationale: Management practices such as grazing, recreation, fuels management and other forms of vegetation management are expected to be designed to provide for the health, form, and function of riparian systems. Determining proper functioning condition (PFC) is an interdisciplinary process.

Attainment of PFC assures that stream and riparian areas function well and are on an improving trend. Until PFC is attained, management priorities and options focus on reaching this threshold over time. The desired condition, supported by Watershed Condition Indicators (WCIs), lies between PFC and biological potential.

NOTE: Standards B-S36, B-S37, B-S38 are activity-based (as opposed to outcome-based) standards that were developed specifically for wildfire suppression because wildfire suppression generally occurs under emergency situations.

B-S36. Standard. Fire suppression strategies, practices, and actions in RCAs shall be designed to attain RCA management objectives, and to minimize disturbances of riparian ground cover and vegetation. Minimum impact suppression techniques (MIST) shall be used within RCAs unless safety to human life or property is an issue.

Rationale: Fire suppression strategies should recognize the role of fire in ecosystem function and identify those instances where fire suppression could perpetuate or be damaging to long-term ecosystem function or aquatic and riparian resources.

B-S37. Standard. Incident bases, camps, helibases, staging areas, helispots, and other centers for incident activities shall be located outside of RCAs. If the only suitable location for such activities is within an RCA, an exemption may be granted following a review and recommendation by a resource advisor. The advisor should prescribe the location, use conditions, and rehabilitation requirements, with avoidance of adverse effects to terrestrial, aquatic, and riparian resources a primary goal. An interdisciplinary team shall be used to predetermine incident base, dipping, and helibase locations during pre-suppression planning.

B-S38. Standard. Delivery of chemical retardant, foam, or additives to, or discharge of gray water into, surface waters shall be prohibited. An exception may be warranted in situations where overriding immediate safety imperatives exist, or, following a review and recommendation by a resource advisor, when the action agency determines an escaped fire would cause more long-term damage to fish habitats than chemical delivery to surface waters.

RCA Delineation

To meet aquatic and riparian objectives, RCAs need to be delineated considering ecological and geomorphic factors, which vary across the project area. Delineation of ecologically appropriate RCAs requires fine-scale application of appropriate criteria using a two-tier approach.

> The **first tier** involves identification of ecological and geomorphic delineation criteria. This first tier analysis is done either through an EAWS or a programmatic planning analysis, whichever is the appropriate scale. This analysis is intended to provide the context needed to understand riparian area interactions and processes.
>
> The **second tier** applies the criteria (or interim criteria) developed from the first tier analysis to specific areas on the ground in conjunction with proposed management activities.

Conceptually, the **first tier** analysis results in identification of ecologically appropriate RCA criteria by using existing information to characterize the extent, conditions, and trends of riparian areas within the analysis area. This analysis identifies dominant physical and biological features in the watershed that influence the riparian network, and addresses important biophysical functions and processes. The issues associated with the riparian system, including past, current, and potential future management emphases, are used to ascertain the rigor and depth of analysis needed. The resulting information is synthesized and interpreted using a process where potential criteria are examined and selected or eliminated based on their appropriateness to meet the overall intent of aquatic and riparian management objectives at the finer-scale.

For example: The characterization may identify that the geographic extent of riparian areas has declined in portions of the analysis area, and therefore the extent of existing riparian vegetation may not be a suitable criterion for identifying RCAs. Another issue might suggest there are important breeding and dispersal corridors for a riparian-dependent species, which could be an important criterion for identifying RCAs at finer scales. Summarizing the physical conditions of the analysis area may stratify valley bottom and stream type combinations into different classes with inherent channel stability and sideslope erosion properties.

The overall intent of the first tier analysis is to document relationships between key riparian processes and functions and ecological and/or geomorphic factors (such as shade and site potential tree height), which should help to appropriately identify RCAs. The Forest Service and BLM will initiate collaboration when developing ecologically appropriate RCA delineation criteria as described in Standard B-S40. Interim criteria will be used to delineate RCAs as described in standards B-S39(S2) and B-S39(S3) until the first tier analysis has been completed

The **second tier** applies the RCA criteria (or interim criteria) to specific areas on the ground while designing and planning proposed management actions. The intent is that the associated site-specific NEPA analysis and decision would disclose how the criteria will be used to delineate RCAs on the ground and the degree to which they provide for riparian processes and functions and contribute to meeting aquatic and riparian management objectives. Any necessary, site-specific refinements of the criteria will also be documented in the NEPA analysis and decision document.

RCA criteria decisions will be subject to ESA consultation if they have the potential to affect listed species or their habitat. On-the-ground delineation of RCAs will be conducted by land management personnel with expertise in the identified riparian functions and processes and local site conditions.

B-S39(S2). Standard ***for S2 Only.***
Prior to conducting or completing EAWS or programmatic planning processes including land use plan revision, the following interim RCA criteria shall apply:

Rangeland perennial and intermittent streams
Interim RCAs consist of the stream channel and the area on either side of the stream extending from the edges of the active channel to the extent of the floodprone width (Rosgen 1994).

Forested perennial streams; and intermittent streams that support fish spawning and rearing
Interim RCAs consist of the stream channel and the area on either side of the stream extending from the edges of the active channel to the top of the inner gorge, or to the outer edges of the floodprone width, or to the outer edges of riparian vegetation, or to a distance equal to the height of two site-potential trees, whichever is greatest.

Forested intermittent streams that do not support fish. Interim RCAs consist of the stream and the area on either side of the stream extending from the edges of the active channel to the top of the inner gorge, or to the outer edges of riparian vegetation, or to a distance equal to the height of one site-potential tree, whichever is greatest.

Ponds, lakes, reservoirs, and wetlands
Interim RCAs consist of the body of water or wetland and the area from the edge of the wetland, pond, or lake to the outer edges of riparian vegetation, or to the extent of seasonally saturated soil, or to a distance equal to the height of one site-potential tree, whichever is greatest.

B-S39(S3). Standard ***for S3 Only.***
Prior to conducting or completing EAWS or programmatic planning processes including land use plan revision, the following interim RCA criteria shall apply:

Rangeland perennial and intermittent streams
Interim RCAs consist of the stream channel and the area on either side of the stream extending from the edges of the active channel to the extent of the floodprone width (Rosgen 1994).

Forested fish-bearing perennial streams
Interim RCAs consist of the stream channel and the area on either side of the stream extending from the edges of the active channel to a distance equal to the height of two site-potential trees.

Forested non-fish-bearing perennial streams
Interim RCAs consist of the stream channel and the area on either side of the stream extending from the edges of the active channel to a distance equal to the height of one site-potential tree.

Forested intermittent streams
Interim RCAs consist of the stream and the area on either side of the stream extending from the edges of the active channel to a distance equal to the height of one-half site-potential tree on forested streams or to the extent of the riparian vegetation on non-forested streams.

Ponds, lakes, reservoirs, and wetlands
Interim RCAs consist of the body of water or wetland and the area from the edge of the wetland, pond, or lake to a distance equal to the height of one site-potential tree.

B-S40. Standard. During EAWS or through the appropriate programmatic planning processes (including land use plan revision) (tier one) interim RCA criteria shall be replaced with ecologically

appropriate criteria that are consistent with the RCA management intent and the attainment of RCA management objectives. This ecologically appropriate criteria shall be identified using scientific information in combination with local knowledge and information on riparian processes and functions, resource values, and risks.

RCAs shall be delineated on an appropriate hydrologic unit basis, not a stream reach basis (tier two). Rationale for final RCA delineation criteria shall be presented through the appropriate NEPA decision-making process.

Rationale: The intent is to replace or modify broad-scale interim RCA delineation criteria with locally defined criteria that would be consistent with the attainment of RCA objectives. Field units must revise the broad-scale interim RCA criteria either when they conduct EAWS or through appropriate programmatic planning processes, including land use plan revision. Although EAWS is not a decision process, it would provide information for ecologically appropriate criteria that would support site-specific NEPA decisions on RCA delineation. Administrative units should consider relevant scientific and local information, riparian processes and functions, resource values, risk, and source habitat for riparian-associated species when defining RCA characteristics.

B-S41. Standard. During land use plan revision, RCAs shall not be included in the suitable timber base used to calculate the allowable sale quantity.

Sediment Delivery Influence Area

Description and Management Intent

The primary management intent of the sediment delivery influence area is to limit sediment entry and overland flow from management actions into the RCA. For example, when designing prescribed fire projects within the influence area, prescriptions should be designed to retain sufficient duff and ground cover to minimize soil movement.

B-S42(S2). Standard *for Alternative S2 Only.* Prior to conducting new management activities, an area influencing sediment delivery to RCAs along perennial and intermittent streams shall be identified, using the definition or process in Appendix 9. When management activities are conducted within the sediment delivery influence area, ground disturbance shall be minimized and sufficient ground cover shall be retained to limit sediment movement into the RCA to allow attainment of RCA objectives.

Rationale: The *Assessment of Ecosystem Components* identified hillslope steepness as an important biophysical principle which underlies a riparian management strategy. As side slopes adjacent to streams steepen, the likelihood of disturbance resulting in discernible instream effects increases. Standard B-S42(S2) addresses this principle and uses relationships developed in the *Assessment of Ecosystem Components.*

B-S42(S3). Standard *for Alternative S3 Only.* Prior to conducting new management activities, an area influencing sediment delivery to RCAs along intermittent streams shall be identified, using the definition or process in Appendix 9. When management activities are conducted within the sediment delivery influence area, ground disturbance shall be minimized and sufficient ground cover shall be retained to limit sediment movement into the RCA to allow attainment of RCA objectives.

Rationale: The *Assessment of Ecosystem Components* identified hillslope steepness as an important biophysical principle which underlies a riparian management strategy. As side slopes adjacent to streams steepen, the likelihood of disturbance resulting in discernible instream effects increases. Standard B-S42(S3) addresses this principle and uses relationships developed in the *Assessment of Ecosystem Components.* In Alternative S3, the sediment delivery influence area is limited to intermittent streams because, based on scientific literature, the narrower RCA width for intermittent streams under this alternative would be insufficient to trap sediment movement in steep country, making the identification of an additional sediment delivery area necessary.

Watershed Condition Indicators (WCIs)

Description and Management Intent

Watershed condition indicators (WCI) are an integrated suite of aquatic (including a biological component), riparian (including riparian-associated terrestrial species), and hydrologic (including uplands) condition measures that are intended to be used at the watershed scale. They are intended to serve two primary purposes:

1. To assist in effectiveness monitoring—as measurable indicators of how effective management actions are in attaining broad-scale ICBEMP aquatic/riparian/hydrologic objectives. *This purpose is discussed further in the Monitoring Framework (Appendix 10).*

2. To indicate the current condition of a watershed and to help land managers design projects and make judgements about the appropriateness of management activities with respect to aquatic/riparian/hydrologic objectives. *This purpose is discussed in the following paragraphs and the accompanying management direction.*

WCIs provide context and decision support to determine whether combined actions would contribute to attainment of objectives at subwatershed and larger scales. The WCIs, including interim NMFS/USFWS matrices (see Appendix 9), should be used as a suite of integrated indicators. They should not be used individually as fixed targets toward which to manage or as specific thresholds from which to make "go/no go" project implementation decisions. However, they should be used to help design appropriate management actions or alter or mitigate proposed actions to move watersheds toward desired conditions. If certain indicators highlight a concern in a watershed, then NEPA analysis would disclose how proposed management actions would be designed to alleviate the concerns, and/or why the proposed action is needed to achieve aquatic/riparian/hydrologic objectives.

The WCI protocol and indicators are expected to be developed by the ICBEMP Implementation and Monitoring team in two to three years after the ROD for the ICBEMP EIS is signed. The ICBEMP protocol will be consistent with the Northwest Forest Plan WCI protocol; however, adjustments or additions to the Northwest Forest Plan indicators may be needed to reflect the range of conditions within the interior Columbia River Basin project area. Values will be assigned to channel, riparian (aquatic and terrestrial), and upland (aquatic and terrestrial) indicators at subregional scales based on relationships among key natural disturbance processes and biological, physical, and chemical characteristics of subwatersheds or watersheds. Local administrative units and interagency partners will participate in development of subregional indicator values relating to resource management objectives.

While WCIs are being developed, the intent is to use the NMFS/USFWS matrices of pathways and indicators (as refined locally) as interim indicators to evaluate project consistency with aquatic, riparian, and hydrologic objectives. (See Appendix 9.)

B-O39. Objective. Evaluate the effects of management on aquatic (including a biological component), riparian (including riparian-associated terrestrial species), and hydrologic (including uplands) condition through Watershed Condition Indicators (WCIs). For aquatic and hydrologic conditions use the NMFS/USFWS matrices of pathways and indicators (see Appendix 9) as interim indicators until WCIs are developed. For terrestrial riparian species, until specific WCIs are developed, consider current levels and changes in quantity, quality, and distribution of: emergent wetland vegetation, wetland or riparian vegetation (grass, herbs, shrubs, and coniferous and deciduous trees), and wetland and riparian snags and downed wood; the composition of communities in terms of native and non-native vegetation; and the presence of roads and human disturbance.

B-S43. Standard. Watershed Condition Indicators (WCIs) shall be developed and refined at the watershed scale to illustrate the variability of watershed condition among watersheds or subwatersheds within a broader context. An interdisciplinary team of local experts shall establish this environmental baseline and evaluate the effectiveness of the aquatic/riparian/hydrologic component of the ICBEMP ecosystem management strategy over time.

The WCIs, in combination with other assessments and cumulative effects analyses, including NEPA, EAWS (where available), and Subbasin Review, shall be used to determine if proposed activities are consistent with and/or contribute toward achievement of the aquatic, riparian, and hydrologic objectives. Each step of the process, including any assumptions developed, shall be documented to illustrate how the intent of the broad-scale direction will be met at finer scales.

Rationale: WCIs are intended to be applied at the watershed scale and can provide context for site-specific NEPA analysis and decisions. Site-specific NEPA analysis (including required cumulative effects analysis) and decisions will address how use of the WCIs has influenced project design and implementation strategy.

WCIs are an integrated suite of measures used to determine how effective management actions are and to help land managers design projects.

B-S44. Standard. While WCIs are being developed, the "matrix of pathways and indicators" (as refined locally by local administrative units and interagency partners) in combination with cumulative effects analysis, NEPA, EAWS (where available), or Subbasin Review, shall be used to help establish an environmental baseline of aquatic resource and watershed

conditions. Effects of actions shall be evaluated against this baseline to determine consistency with aquatic, riparian, and hydrologic objectives in the ICBEMP ecosystem management strategy. Actions which could negatively affect fundamental physical and ecological processes within a watershed in the long term (more than 10 years) shall be redesigned to be consistent with the aquatic, riparian, and hydrologic objectives.

Rationale: Interim indicators are intended to be applied at the watershed scale and can provide context for site-specific NEPA analysis and decisions. Site-specific NEPA analysis (including required cumulative effects analysis) and decisions will address how use of the interim indicators has influenced project design and implementation strategy.

B-G43. Guideline. As part of the suite of WCIs, consider including qualitative and quantitative watershed disturbance indicators (natural and management) for uplands and riparian areas to provide early indication of potential watershed cumulative effects and potential restoration opportunities.

Water Quality and Hydrologic Processes

Description and Management Intent

The Clean Water Act (CWA) mandates the Bureau of Land Management (BLM) and the Forest Service, as federal land management agencies, to protect and restore the quality of public waters under their jurisdictions. Although the Environmental Protection Agency (EPA) has ultimate responsibility for administering the Clean Water Act, states and tribes have primary responsibility for implementing many of its provisions. Water quality standards have been established by states and tribes, and approved by the EPA, to ensure beneficial uses are supported. Federal land management agencies are designated by the states to assist in Clean Water Act implementation.

Federal land management agency obligation under the Clean Water Act is to protect and maintain water quality where it meets or exceeds EPA-established or EPA-approved state and tribal water quality standards. This obligation includes compliance with state anti-degradation, High Quality Waters, and Outstanding Resource Waters policies. The application of Best Management Practices (BMPs)—including land allocations, prescriptions, mitigation measures, and planning requirements—is the main mechanism (section 319) for achieving this obligation.

Water bodies having impaired water quality are in part identified on the respective states' 303(d) lists. A protocol for addressing restoration and maintenance of 303(d) waters on BLM- and Forest Service-administered lands was developed collaboratively and adopted for the area included in the ICBEMP project area (USDA Forest Service and USDI BLM 1999). Application of this 303(d) protocol provides reasonable assurance that listed and threatened waters, as well as waterbodies not meeting water quality standards, will be addressed in a consistent manner at an appropriate scale and level of technical rigor.

B-O40. Objective. Maintain water quality and hydrologic processes necessary to support beneficial uses including healthy riparian, aquatic, and wetland ecosystems. Water quality and hydrologic processes should be within the range of variability representative of the inherent capability of the watershed area that supports beneficial uses.

Rationale: The processes that determine water quality condition are not static but vary within a stream system through space and time. Ranges of conditions are difficult to define because the variation is influenced by many factors, including climate, natural and human-caused disturbances within the watershed, and the natural capability determined by the specific geomorphic characteristics of the stream and surrounding watershed. The intent is to manage the watershed toward water quality frequencies and distributions that fully support beneficial uses and that are more consistent with natural patterns characteristic of geomorphically similar watershed areas. Until these ranges are determined and water quality standards are modified to reflect these ranges, existing water quality standards are the minimum legal limit for water quality.

B-S45. Standard. The application of the 303(d) protocol at watershed or subbasin scale shall be scheduled as part of Forest Service and BLM annual planning processes, and shall be implemented to assure that all 303(d)-listed water bodies in a watershed and/or subbasin that are affected by activities on Forest Service- and BLM-administered lands are addressed in a timely manner. The schedule shall consider states' and/or tribes' priority lists and schedules for TMDL development, results of Subbasin Review, and/or EAWS where available, and schedules and restoration plans resulting from implementation of the Clean Water Action Plan (CWAP).

Rationale: The Forest Service and BLM have established a goal of addressing all listed 303(d) water bodies within a five-year period. To realize this goal, it will be necessary to systematically schedule and apply the protocol to an entire drainage (either watershed or subbasin scale). States have developed total maximum daily load (TMDL) priorities and schedules on a watershed or subbasin scale while providing flexibility to complete smaller-scale TMDLs on portions of the watershed or subbasin within the schedule for the watershed or subbasin. The purpose of this standard is to assure that restoration of 303(d)-listed water bodies on Forest Service- and BLM-administered lands is considered in a broader context than provided by a project scale. It also should assure that appropriate coordination and collaboration occurs with other efforts to restore water quality on all lands within an entire drainage. The application of the protocol in this context will provide key information to states and tribes for incorporation into the development of the overall TMDL for an entire drainage.

The protocol includes three key components: goals, strategy, and decision framework. The goal for addressing 303(d) waterbodies states a five-year time line (approximately the year 2005) while accommodating state and tribal schedules for development of TMDLs and Clean Water Action Plan implementation (Unified Assessments and Restoration Strategies). The intent of this goal is to be proactive in restoring 303(d)-listed waterbodies on Forest Service- and BLM-administered lands as well as to collaborate with other ongoing efforts to restore water quality on all lands. It also provides information for the federal portion of the TMDL to states and tribes for incorporation into the development of the overall TMDL that includes all ownerships. Although TMDLs and CWAP implementation are generally planned for a subbasin, portions of the plans will be specific to smaller areas within the subbasin such as a watershed or stream reach to allow flexibility to proceed with appropriate activities.

The 303(d) protocol provides a consistent approach for addressing Clean Water Act responsibilities on Forest Service- and BLM-administered lands. Application of the protocol provides assurance that federal management activities in 303(d) listed water bodies will contribute to the maintenance or restoration of water quality. The decision framework is a four-step process that may result in development of a water quality restoration plan. The assessment supports development of a water quality restoration plan and is independent of scale, but guidance is provided to assist in selection of the scale(s) most likely to effectively develop an appropriate solution. It provides the mechanism to proceed with federal land management in listed water bodies prior to state approval or development of a TMDL. Results from application of the protocol will also support state development of TMDLs. Also, there may be instances when federal land management agencies have opportunities or need to proceed with water quality restoration activities in subbasins under time frames that are ahead of 303(d) priorities, state TMDL schedules, or priorities identified in State Unified Watershed Assessments. Under these circumstances the resulting WQRP would include the appropriate elements to facilitate future analyses and planning processes.

B-S46. Standard. Apply the 303(d) protocol where any land management activity has the potential to affect the parameter(s) for which the waterbody was listed, or where water quality standards are not being met because of land management activities on BLM- or Forest Service-administered lands. Land management activity includes new, existing, and ongoing activities. Any resulting water quality restoration plans shall be implemented as part of or prior to proceeding with the activity.

Rationale: Application of the protocol for all impaired waters on Forest Service- and BLM-administered lands will take several years to complete. In the interim, using the protocol on a project-driven basis will provide assurance that new activities, or any existing activity where new information shows water quality is adversely affected, will contribute to the restoration of water quality.

This standard is also intended to prevent further degradation where water quality is currently not meeting EPA-established or EPA-approved state or tribal water quality standards and to restore water quality to support beneficial uses. Proactively maintaining and/or restoring water quality should prevent listing and will facilitate restoration of water quality in a timely and efficient manner, in the long term.

B-O41. Objective. In subbasins (or within smaller watershed areas) with mixed ownership, use the 303(d) protocol on federal lands, and provide the opportunity to use the protocol to address water quality problems collaboratively with non-federal landowners, watershed councils, state agencies, tribes, Natural Resource Conservation Service, and other interested parties. Strive to develop water quality restoration plans that apply to an entire watershed or subbasin.

Rationale: To best address and restore water quality where listed water bodies encompass mixed ownership geography, development of water quality restoration plans should be a collaborative effort among interested parties. Federal agencies should be a party to development of any WQRPs or programs that restore impaired water bodies where federally administered lands are involved. Unified efforts to address water quality on a total watershed basis are also consistent with goals and objectives specified in the Clean Water Action Plan (CWAP).

B-O42. Objective. Use existing Memoranda of Understanding (MOUs) with state water quality agencies to develop partnerships that include other federal, state, county, and tribal organizations, watershed councils, private citizens, and non-federal land owners, to maximize the benefits of existing efforts for water quality protection and restoration. Also see objective R-O33 under Restoration Direction.

Rationale: Other federal and state agencies, tribes, counties, and interested stakeholders within the project area have developed or are in the process of developing water quality restoration plans. Many of these efforts are striving to accomplish similar outcomes, and the greatest benefits and returns on investments can be obtained where mutual priorities or opportunities can provide a pool of resources to more effectively implement management activities.

Terrestrial and Aquatic Species

Viability and Harvestability

Description and Management Intent

The following section contains management direction for three specific areas for terrestrial and aquatic species habitats:

1. Providing for conservation of basin-wide species of concern;
2. Providing quality habitat to support harvestability, which is important to both tribes and states; and
3. Providing for terrestrial and aquatic species habitats which are not addressed by source habitats or with other direction (such as species with special habitat needs). Additional management direction that relates to species habitats is also found in other sections.

One intent of the direction in this section is to consider and provide well-connected networks of habitat for productive and diverse populations and communities of terrestrial and aquatic species during planning for management actions. The intent is not for management actions to optimize or maximize habitat for a particular species or group of species (although it doesn't prohibit doing so). It is neither necessary nor practicable to consider every species during every analysis. Rather, those species or groups of species whose habitat may be substantially affected by a proposed activity should be considered. ("Substantially affected" means having greater than a "slight effect," and, more often, affecting the productivity or distribution of a population or community.)

Another intent of this section is to provide habitat capable of supporting harvestable resources. Harvestability is a combination of animal or plant availability and access to harvest them. An issue common to the four states in the project area is harvestability of fish and game species, such as trout, elk, and mule deer. Hunting, fishing or viewing these and other species is important to many people in the project area. The BLM and Forest Service, while not directly responsible for management of species populations, are responsible for the habitat upon which these species depend, and the agencies' management actions can influence harvestability. The Forest Service and BLM decision makers for the ICBEMP have committed to providing habitat capable of supporting harvestable resources.

One of the primary issues common to nearly all 22 potentially affected tribes is harvestability of important aquatic and terrestrial species, such as salmon, mule deer, and camas (see Chapter 2 for more detail). These species, besides being associated with a number of the tribes' off-reservation reserved treaty rights, are integral to the culture of many of the tribes within the project area. At issue is the availability of sufficient numbers of these species (aquatic, animal, and plant) for contribution to the culture and the meaningful exercise of the reserved rights, where they exist.

For some species associated with the rights and interests of tribes, sufficient habitat is or can be made available for harvestable populations in 10 to 15 years. However, in the case of anadromous fish, habitat accounts for only a portion of one of four factors related to recovery and harvestability. The other factors (harvest, hydropower, habitat on lands not administered by the Forest Service or BLM, and hatcheries) are outside the scope of the EIS and outside the authority of the Forest Service and BLM decision makers. Therefore, the intent is to maintain

or restore quality habitat on Forest Service- and BLM-administered lands. This habitat will be available to support species to progress to harvestability in 50 years. Addressing other limiting factors which influence recovery and harvestability, such as effects of hydropower systems, could shorten the time frame for achieving this objective. Chapter 4 describes the ability of each alternative to address viability of anadromous fish and establish the trend toward meeting the management intent of harvestability over time. Progress toward achieving this intent will be measured through monitoring.

Direction to address this management intent is provided throughout the management strategy and specifically for harvestability in this section. Each of the affected tribes has unique rights, interests, and opportunities which can best be discussed at finer scales with land managers, rather than at the broad scale. Therefore, management direction tends to be process oriented, focusing on the expected outcome of implementation.

B-O43. Objective. Provide habitat capable of: (1) supporting viable populations of plant and animal species, (2) contributing to recovery of listed species, and (3) supporting productive and diverse plant and animal populations and communities to meet social needs.

Rationale: Consideration of plant and animal species habitat (for example, riparian areas and wetlands; alpine; and upland forest, shrub, and grasslands) is important in design and evaluation of management actions. Important elements include: amount, quality, and distribution of these habitats including their fragmentation, juxtaposition to other habitats, and connectedness; influence of human disturbance and roads; and ecosystem processes that shape habitat.

Rare plant communities and habitat for plants, animals, and fishes of concern (that is, endemic, rare, or disjunct species, and species that occur at the edge of their ranges) should be considered during appropriate step-down processes (programmatic planning processes, Subbasin Review, EAWS, and/or site-specific NEPA analysis). Species and communities of concern vary over time and by area. Managers should determine the appropriate and reasonable analysis levels by which to address them, given the risks and opportunities to affect their habitat.

B-G44. Guideline. Consider developing an interim species response matrix that includes documented (from literature searches) responses of the species to management activities or natural phenomena. Consider using this information to determine management activities for which mitigation measures should be recommended or are needed.

B-O44. Objective. Maintain and restore aquatic and terrestrial habitat quality and quantity to support harvestable plants, fisheries, and aquatic and terrestrial species.

Rationale: The Forest Service and BLM manage habitats that are important to many species. Through management actions, habitat for harvestable plant and animal species can be positively or negatively affected. It is important that potential effects on habitat to support harvestable levels of animal and plant species be evaluated during planning processes.

Harvestability is a combination of animal or plant availability and access to harvest them. Managing human access is one of the more effective tools that the Forest Service and BLM have to protect a species and its habitat. However, this tool must be used carefully when considering harvestability of a species. Restrictions on access may protect a species and its habitat but may also reduce harvestability by making animals or plants harder to take or gather.

Management of animal species populations is often the responsibility of other agencies (such as states or tribes) whose management actions can have substantial effects on species populations. For these species, the Forest Service and BLM can provide habitat, but they have less control over a species' population response to that habitat. Management of plant species populations is more commonly the responsibility of the Forest Service and BLM, which have a greater opportunity to positively influence harvestability of these species.

Habitat condition trends for terrestrial and aquatic species can be measured, for the most part, in terms of habitat condition on lands administered by the Forest Service and BLM. Land use plans generally include habitat condition indicators for important aquatic and terrestrial species (such as fishes, elk, deer). Habitat condition also is the best measure of Forest Service and BLM ability to maintain or restore harvestability for most plants including widely distributed plant species such as huckleberries and mushrooms. For some very rare species (such as plants restricted to only a few sites), it may be necessary to measure actual population numbers to prevent overharvest.

B-S47. Standard. During EAWS or Subbasin Review, or prior to project implementation, federally recognized tribes shall be consulted to: (1) invite participation, (2) solicit data and information useful in the analysis/review, (3) identify if resources or species of significance to the tribe(s) are present, (4) characterize these resources or species using available information, (5) solicit tribally identified priorities and possible management and monitoring opportunities or indicators, and (6) use this information to provide context for finer scale analysis as well as to inform planning and decision-making processes.

Rationale: Land management agencies are responsible for the habitats upon which resources and species important to the tribes depend. In order to provide habitat capable of providing harvestable resources or species, the managers must understand what and where these resources are and how they relate and contribute to the ecosystem and landscape dynamics. As managers of their own land and natural resources, American Indian tribes may have data, information, or expertise that could be useful in informing agency planning and decision-making processes.

B-O45. Objective. Recognize native plant communities as traditional resources that are important to tribes and as an essential component to treaty-reserved gathering rights.

B-S48. Standard. Affected tribes shall be consulted and worked with to identify opportunities to restore and maintain native plant communities that are of interest to tribes. Where tribal interest is indicated, cooperative programs for restoration and/or maintenance of these species shall be established.

B-S49. Standard. As part of site-specific NEPA analysis, affected federally recognized tribes shall be consulted to: (1) identify resources or species important to tribal rights and/or interests, (2) assess effects of the proposed action(s) on these resources and/or species, and (3) if it is determined that the project may negatively affect the continued harvestability of these resources or species of significance to tribes, then mitigate accordingly.

Rationale: Land management agencies are responsible for the habitats upon which resources and species important to the tribes depend. In order to provide habitats capable of supporting harvestable resources or species, agencies must understand what and where these resources are and how they might be affected by proposed management actions.

See Appendix 10 and the Subbasin Review Guide for implementation guidance on tribal collaboration and examples/possible questions to help focus discussions. Also, a list of culturally significant plant species is included in Appendix 8. This list is meant to serve as a starting point for collaborative discussion with tribes, because the species listed may not occur in all areas or be used by all tribes. See also the scientific assessment of big game species as they relate to tribes (Lehmkuhl and Kie 1999).

B-O46. Objectives. Special habitat components or features that contribute to the viability of species should be maintained and, where needed, restored. These features include but are not limited to caves, mines, cliffs, talus, or burrows.

Rationale: The specific habitats or elements described here were identified in the *Assessment of Ecosystem Components* (Quigley and Arbelbide 1997) and in *Source Habitats* (Wisdom et al. in press) as critical to long-term conservation of a variety of species. (For species list, see Appendix 6).

B-G45. Guideline. Contingent on human safety concerns, consider managing human access and minimizing potential disturbances to protect caves, old mines, old buildings, bridges, and other sites being used by bats.

B-S50. Standard. When planning management activities, determine if there could be adverse effects on special habitat features (caves, mines, cliffs, talus, or burrows). Discuss and minimize or mitigate effects.

Rationale: The assumption is that the special habitat features mentioned in this standard warrant protection because disturbance factors, cost, and safety considerations often preclude determining presence of species (such as bats in roosts or hibernacula) that use these features. Development of protective measures for these sites must include consideration of effects from vegetation management, access management, and human disturbance. The specific habitats or elements were identified in the *Source Habitats for Terrestrial Vertebrates of Focus in the Interior Columbia Basin* (Wisdom et al. in press, Vol. 3, Appendix 1, Table 2) as critical to long-term conservation of a variety of species. This information can be used in evaluating effects during Subbasin Review, EAWS, and site-specific NEPA analysis.

Other special habitat components, such as snags, coarse woody debris, and riparian shrubs, are covered under other objectives and/or standards. This standard is intended to address those special habitat components without other specific direction.

B-S51. Standard. The risks and opportunities associated with conservation of rare plant communities and habitat for plant, animal, and fish species of concern shall be addressed through the appropriate step-down processes (programmatic planning processes, Subbasin Review, EAWS, or site-specific NEPA analysis). (See Appendix 6 for the list of species.)

Rationale: *Species of concern* can be identified from many sources during the appropriate step-down processes. Examples include: species listed under the Endangered Species Act, Forest Service and BLM sensitive species lists, species ranked as G1BG3 or nonvascular plants ranked as S1BS3 by the network of State Natural Heritage programs, broad-scale species listed in Volume 1, Table 1 of Wisdom et al. (in press), species listed in Table 2 in Croft et al. (in press), and plant communities ranked G1BG3 by the network of State Natural Heritage programs.

Not all the species need to be considered in any one step-down process. The appropriate and reasonable scope and scale of analysis will depend on the species of concern and the magnitude of risks and opportunities to affect their habitat. This determination may be based on existing habitat data and professional knowledge of the species.

Species listed under the ESA or classified as sensitive species through Forest Service or BLM processes will continue to be addressed through established agency policy (see Appendix 6).

B-G46. Guideline. Local administrative units are encouraged to develop a list of plant, animal, and fish species of concern and rare plant communities that are likely to occur within the unit.

B-S52. Standard. For projects or activities that include application of insecticides or rodenticides, potential effects on non-target species shall be evaluated and either minimized or mitigated.

Rationale: Insecticides and rodenticides can affect non-target species through bioaccumu-lation of the pesticide or direct mortality. Adverse affects on non-target species can seriously reduce the overall benefits from use of insecticides or rodenticides.

B-O47. Objective. Improve the conservation and recovery of vascular and non-vascular plant species of concern that have wide distribution by developing conservation strategies (see the list of species in Appendix 6). The priority for development of the conservation strategies should be based on broad-scale risk. A conservation strategy would include the entire range of a species and should be developed collaboratively by all affected agencies and administrative units.

Rationale: Conservation strategies for species of concern should be developed by a group of local experts for each region in which the species occurs. This will aid conservation and recovery of these widely distributed species. A species of concern has a wide distribution if it occurs in more than one RAC/PAC and/or in two or more administrative units, and are listed as threatened or endangered, classified as sensitive species by the Forest Service or BLM, or ranked as G1-G3 by the network of State Natural Heritage programs. Currently there are approximately 113 species which meet this definition (see Appendix 6); therefore, it is anticipated that it will take some time to develop strategies for all these species. Two considerations for setting priorities for development of conservation strategies should be:

1. species that are at most risk; and
2. species that occur on the greatest number of administrative units. Regularly monitoring the State Natural Heritage program databases for changes in species' rankings will assist in prioritization.

B-O48. Objective. Reduce the negative effects of human disturbance on species through assessment of risks and opportunities in the appropriate step-down process (programmatic planning processes, Subbasin Review, EAWS, or site-specific NEPA analysis).

Rationale: Disturbance by humans can have adverse affects on a wide range of species (Wisdom et al. in press). Some disturbance is inevitable and acceptable with human use of BLM- and Forest Service- administered lands. However, there are often ways to reduce disturbance of species and continue to allow people to use these lands. The potential to reduce human disturbance while providing for appropriate human use should be evaluated during the step-down processes. If opportunities are identified through Subbasin Review or EAWS, then they should be considered in site-specific NEPA for implementation. (NOTE: Also see Road Management Objectives, Standards, and Guidelines earlier in Base Level Direction.)

Wide-ranging Carnivores

Description and Management Intent

Populations of these species have been reduced from historical levels. Two of the species, gray wolf and grizzly bear, have been listed under the Endangered

Species Act and another, the lynx, is proposed for listing. Deterrents to the recovery of these species include human disturbance (including roads), and loss or isolation of habitat. The intent of this section is to provide broad-scale management direction for wide-ranging carnivores (lynx, wolverine, grizzly bear, and gray wolf). These species are considered wide-ranging because their territories cover great distances (often more than 50 miles).

Areas containing moderate to high abundance of source habitat for wide-ranging carnivores and low road densities were identified by the Science Advisory Group in *Source Habitats for Terrestrial Vertebrates of Focus in the Interior Columbia Basin* (Wisdom et al., in press); see Map 2-11b in Chapter 2 of this EIS. These areas are important in that they presumably would have the highest potential to support persistent populations. They could serve as "building blocks" from which an overall network of habitats for wide-ranging carnivores could be developed.

B-O49. Objective. Coordinate across multiple jurisdiction boundaries to develop broad-scale connectivity/linkages of wide-ranging carnivore habitat.

Rationale: Use the areas shown on Map 2-11b as building blocks from which to build connectivity. Habitat for wide-ranging carnivores cross multiple jurisdictional boundaries throughout the project area. Isolation of these habitats limits increases in species populations. Ensuring that wide-ranging carnivore habitats are linked across multi-jurisdictional boundaries can help prevent this isolation from occurring.

Providing such habitat connectivity requires multi-jurisdictional coordination. The purpose of this objective is to clarify that the Forest Service and BLM managers shall take the lead in coordinating efforts to provide for broad-scale connectivity of habitat for wide-ranging carnivores. This should include identifying the factors causing habitat isolation and coordinating actions to reverse the trend. Progress toward establishing broad-scale connectivity should be evident in ten years.

B-O50. Objective. Minimize isolation of wide-ranging carnivore populations at the local level using existing planning processes and coordinating across administrative boundaries.

Rationale: Objective B-O49 addresses habitat connectivity at the broad scale, but it is important to minimize isolation at finer scales. Stepping down broad-scale direction through coordination at subbasin and finer scales will complement efforts made under objective B-O49.

B-S53. Standard. As part of Subbasin Review, identify and map important wide-ranging carnivore areas, as well as existing and potential dispersal corridors for wide-ranging carnivores.

Rationale: Areas important to wide-ranging carnivores at subbasin and finer scales can be identified through habitat characteristics, documented sightings, and professional judgement. Information in *Source Habitats for Terrestrial Vertebrates of Focus in the Interior Columbia Basin* (Wisdom et al. in press) will be helpful in identifying these areas. See Map 2-11b for areas with high abundance of source habitat for wide-ranging carnivores and low road densities, mapped at the broad scale.

B-O51. Objective. Minimize or mitigate negative effects on wide-ranging carnivores and their prey during the design, development, and management of recreation facilities and other management activities, including snowmobile areas and trails.

B-S54. Standard. When planning for site-specific activities within areas identified as important to wide-ranging carnivores, documentation in NEPA analyses (EAs or EISs) should include the predicted effects of these activities on source habitat for these carnivores and their prey species at the subbasin level.

Aquatic and Terrestrial Threatened, Endangered, Proposed Species

Description and Management Intent

The Forest Service and BLM have legal responsibilities and policy requirements to provide habitat for threatened, endangered, and proposed species. Meeting these responsibilities requires maintenance of high quality habitat and restoration of degraded habitats necessary for the recovery of these species.

Aquatic and terrestrial threatened, endangered, or proposed species areas include both occupied habitat and designated critical habitat for federally listed threatened, endangered, or proposed species within the ICBEMP project area. The management intent is to protect and restore habitats for listed or proposed species and to contribute to recovery. Table 2-24 (in Chapter 2) and Appendix 6 show a current list of threatened, endangered, proposed, and candidate species in the project area.

Since a large portion of the project area is occupied by listed or proposed species or is designated critical habitat, and since a large portion of the project area is

in need of terrestrial habitat restoration, watershed restoration, and restoration of succession/disturbance regimes, potential conflicts may exist between short-term protection of listed or proposed species habitats and long-term recovery and resiliency of ecosystems that they inhabit. The hierarchical step-down analysis direction presented in the Step-Down section should aid land managers in strategically identifying risk and opportunities for conservation and restoration of listed species habitats while implementing approved recovery plans and meeting resource objectives and legal requirements. The Forest Service and BLM will continue to consult with the U.S. Fish and Wildlife Service and the National Marine Fisheries Service on agency decisions that may affect listed species or their habitat.

Acceptable levels and types of risk are expected to be determined at an appropriate level through the step-down process and are intended to be consistent with aquatic and riparian objectives, base level, A1, A2, and restoration direction. Long-term negative effects are unacceptable. Risky, experimental actions would be an exception in listed and proposed species habitats and would be limited in scope and intensity. If any proposed activity were determined to have potential negative impacts on listed or proposed species or their habitat, Ecosystem Analysis at the Watershed Scale (EAWS) would be required to further provide context for agency decisions (see Standard B-S5[S2]). If, after incorporation of EAWS information into site-specific activity planning, the effect on listed or proposed species and their habitats would still be adverse in the short-term, then NEPA and consultation documents would clearly describe the short-term risk and hazard and long-term benefits of the activity, including a discussion of why other alternatives would not provide for long-term recovery of the listed or proposed species.

The following management direction for listed and proposed species would take precedence over ICBEMP base level direction, restoration direction, and less restrictive direction in land use plans (see the Hierarchy of Management Direction section, earlier in this chapter).

B-O52. Objective. Contribute to recovery of federally listed or proposed species (or subspecies or populations) across their ranges by maintaining and restoring habitat quality, quantity, and effectiveness.

B-O53. Objective. Balance the need for restorative actions to address long-term threats to listed and proposed species with the short-term need to protect listed and proposed species and their habitats.

Rationale: Improving the sustainability of a species' habitat is advantageous for its long-term recovery. This can involve repatterning vegetation to cover types and structural stages that are more consistent with the landform, climate, biological and physical characteristics of the ecosystem. At times, efforts to improve sustainability of habitat may pose a short-term risk to individual members of a listed species or their habitat. It is important to balance the short-term risk to individuals or the potential loss of habitat against the long-term benefits to the species as a whole. Generally, if an action is determined to have a "may affect, but not likely to adversely affect" determination, then the risk is acceptable. In some cases, an action may be acceptable if it is determined to have a short-term "may affect, likely to adversely affect" where the adverse effects are limited to the short-term loss of individuals or their habitat. In these cases, through consultation with the USFWS or NMFS it may be determined that the action is not likely to jeopardize the species in the short term, and that the action may actually benefit the species in the long term.

B-S55. Standard. Relevant management activities shall be designed and implemented to be consistent with approved recovery plans, conservation strategies, and other appropriate reports.

Rationale: Some federally listed species have approved recovery plans (see Table 1 in Appendix 6). These recovery plans identify specific recovery actions, some of which are oriented toward improving watershed and habitat condition. *Relevant* signifies that this standard would not apply to management activities that would <u>not</u> affect a listed species that has an approved recovery plan or conservation strategy. An example of *management activities* is recommended recovery tasks for Forest Service- and BLM-administered lands identified in recovery plans. *Other appropriate reports* (such as the Interagency Grizzly Bear Committee Task Report) include Forest Service or BLM direction that addresses conservation of a listed species.

B-O54. Objective. Consult with and seek the participation of affected American Indian tribes, to the extent practicable, when actions planned under the Endangered Species Act have the potential to adversely affect tribal trust resources, the exercise of tribal rights, or Indian land. Implement the associated Joint Secretarial Order #3206, June 5, 1997.

Social–Economic–Tribal Component

Description and Management Intent: Overall

The socio-economic-tribal component of the ecosystem management strategy is designed to support the economic and social needs of people, cultures, and communities of the interior Columbia Basin, and to provide for sustainable levels of products and services from lands administered by the Forest Service and BLM within the capabilities of the ecosystem. Reservation communities are also some of the most economically depressed areas in the United States (Bureau of Labor Statistics, American Indian Labor Force, January 1991). Tribes and tribal communities depend on Forest Service- and BLM-administered lands for economic, cultural, subsistence, religious, and treaty purposes. The culture, as well as the rights and interests of American Indian people, are rooted in these lands, which are their traditional homelands. Tribal teachings are based upon understanding the relationship between themselves as a people, and the land and its resources. While these values cannot be quantified in an economic context, tribal economic participation is an important consideration in the management of these lands. Major areas of focus for this component include the following:

1. Recognition that Forest Service- and BLM-administered land will continue to be managed in accordance with the management direction in land use plans developed locally, through a public process, unless specifically superseded by ICBEMP direction.
2. Identification of areas or communities thought most economically affected by changing land uses on Forest Service- and BLM-administered lands.
3. Management direction that emphasizes the production of commercial products or services from Forest Service- or BLM-administered lands within the scope of achieving project ecological goals, especially in defined tribal areas and areas considered economically affected by changing land uses on Forest Service- and BLM-administered lands.
4. Methods to enable local and tribal communities to benefit from jobs generated by ecosystem restoration and other land management activities on Forest Service- and BLM-administered lands.
5. Methods for the Forest Service and BLM to contribute to local and tribal economic adjustment and development efforts.
6. Recognition that success in achieving the social and ecological goals of ecosystem management depends on effective collaboration.
7. Recognition that roads will be managed to reduce negative environmental effects, and that access provided by a well-managed road system delivers many benefits to society.
8. Suggestions for new policy and/or legislative initiatives can help the Forest Service, BLM, and other agencies be more responsive to the social and economic needs of tribal and rural communities.

Objectives, standards, and guidelines found in other base level sections related to landscape dynamics, terrestrial, and aquatic/riparian/hydrologic resources have direct or indirect relevance to the breadth of social, economic, and tribal concerns and interests. Such direction is intended to be part of the social-economic-tribal component. Direction found in this section is specific to the support of communities and tribes through products, services, contracts, and particular tribal aspects not addressed in other sections.

Products and Services from Public Lands

Description and Management Intent

The following objective was developed to encourage and support peoples' use of public land resources within the capacity of ecosystems to provide these products and services at a sustainable level, and consistent with other ecological and restoration goals. The intent is to support economic activity for local and tribal communities, particularly those that are isolated and economically specialized, which will help maintain their viability as they move toward achieving their long-range goals of economic development and broader economic diversification.

B-O55. Objective. Derive social and economic benefits, promote commercial activity, and foster demand for labor and capital formation through producing a variety of goods and services from Forest Service- and BLM-administered lands according to land management plan allocations and management direction.

Rationale: Goods and services, both market (priced) and non-market (not priced) can be used to generate economic activity and fulfill social and cultural needs. This objective shows an intent to continue to supply a mix of economic benefits, including commodity products, as part of achieving ecological goals. Where agency land use plans are not superseded by ICBEMP and other applicable direction, local units will be able to continue to implement the management direction in their plans with regard to production of goods and services.

Support Economic and Social Needs of Communities and Cultures

Description and Management Intent

The following objectives and standards are designed to promote agency support for, and collaboration with, local and tribal communities when developing methods to support their social and economic needs. The intent is to integrate the needs of local and tribal communities more thoroughly into agency decision-making and management activities. Methods may range from targeting contracts for the local workforce to a greater coordination and streamlining of agency planning efforts.

B-O56. Objective. Target contracts for services and sale of products from federal lands to local firms and individuals as permitted by existing authorities and where it will help achieve management objectives. Design product sales and service contracts to promote local participation of vendors and purchasers by offering sales and contracts that are diverse in size, type, term length, and seasonal distribution.

Rationale: The participation of the local workforce in management activities on nearby Forest Service- and BLM-administered lands is important to many rural community economies. In addition to providing local jobs and income, such participation supports traditional occupations and cultures, and gives communities a stronger sense of involvement with neighboring Forest Service- and BLM-administered lands.

B-G47. Guideline. Consider applying information learned from Stewardship End Result Contracting Demonstration Projects (Section 347, Fiscal Year 1999 Appropriations Bill), which authorized contracts with private individuals and entities to perform services in exchange for the market value of commercial forest products. Services may include: (1) road and trail maintenance or obliteration to restore or maintain water quality, soil productivity, habitat for wildlife and fisheries, or other resource values; (2) setting prescribed fires to improve the composition, structure, condition, and/or health of stands or to improve wildlife habitat; (3) non-commercial harvest of trees or other activities to promote healthy forest stands, reduce fire hazards, or achieve other non-commercial objectives; (5) watershed restoration and maintenance; (6) restoration and maintenance of wildlife and fish habitat; and (7) control of noxious and exotic weeds and reestablishing native plant species.

Rationale: The stewardship contracting authority is a good opportunity to showcase what can happen when the Forest Service and BLM are able to combine procurement and timber sale contracts. This approach will give the agencies the latitude to offset restoration costs through the value of forest products harvested. The appropriations language is flexible and allows the agencies to be innovative in implementing projects for a small number of demonstration projects.

B-S56. Standard. Ensure projects and contracts administered by the Forest Service or BLM use the authorities and requirements that provide for greater participation of tribal businesses/entities both on and off-reservation.

Rationale: See the Self Governance Act of 1994; Indian set-aside and other minority business requirements for the Small Business Association; the Indian Education and Self Determination Act of 1975, as amended (PL 93-638); Public Law 94-148, Buy Indian Act, Rural Community Assistance Act, and other applicable portions of the Farm Bill; and other laws as discussed in Appendix 8.

B-O57(S2). Objective *for Alternative S2 Only.* Cooperate with federally recognized tribes and tribal communities in their efforts to enhance reservation economies. Promote the economic participation of the local workforce in management activities on Forest Service- and BLM-administered lands where opportunities exist to provide for the rights and interests of tribes.

Rationale: Reservation communities are some of the most economically depressed communities in the nation regarding employment and income levels. The tribal communities in Table 3-3, later in this chapter, are where tribal offices are located and tend to have the greatest concentration of tribal members.

Tribes depend on Forest Service- and BLM-administered lands for employment opportunities (such as contracted services or firefighting), subsistence, religious and cultural activities, and to exercise their treaty rights. The federal/tribal trust relationship denotes a unique federal responsibility to tribes that is different from other governmental entities or the general public.

B-O57(S3). Objective *for Alternative S3 Only.* Cooperate with federally recognized tribes and tribal communities in their efforts to enhance reservation economies. Promote the economic participation of the local workforce in management activities on Forest Service- and BLM-administered lands. Place the highest priority on management activities in subbasins that are

near or contain reservations, and that have the opportunity to provide for the rights and interests of tribes.

Rationale: See rationale for Objective B-O57(S2). Objective B-O57(S3) has a stronger emphasis on conducting activities near reservations than does Objective B-O57(S2), which is consistent with the emphasis in Alternative S3 of identifying high restoration priority subbasins near isolated and economically specialized communities.

B-O58. Objective. When promoting the economic participation of the local workforce in management activities, place the highest priority on activities in nearby rural communities or geographic areas that are less economically diverse and more economically associated with goods and services from Forest Service- and BLM-administered lands. These places are referred to in this EIS as "Areas of Economic Specialization" (Map 2-33, in Chapter 2). See also objective R-O34(S3) in the Management Direction–Restoration section.

Rationale: The intent of this objective is to help sustain an area through the transition. The objective is not intended to discourage or mask the need for economic diversification or other economic development efforts in economically specialized areas. The objective stems from the recognition that few economic options are available in these areas, that BLM and Forest Service actions may be able to contribute to community vitality, and that the continued existence and vitality of these areas is in the public interest. For more information on how Areas of Economic Specialization were measured, see the *Economic and Social Conditions of Communities* (ICBEMP 1998). While this objective is the same for both Alternatives S2 and S3, more high restoration priority subbasins near economically specialized communities are identified in Alternative S3.

B-O59. Objective. Promote collaboration through increased intergovernmental coordination with federal, state, county, and tribal governments, and Resource Advisory Councils, in planning, implementation, and monitoring efforts.

Rationale: In addition to contributing to more informed decision making, collaboration is expected to contribute to more predictable implementation of land use plans by fostering support of decisions. Improved collaboration can improve predictability by increasing the level of public support for, and reducing resistance to, management strategies and activities.

B-S57. Standard. Within two years after the Record of Decision for this EIS is signed, national forests and BLM districts (individually or in groups) shall initiate a memorandum of understanding (MOU) or equivalent document with appropriate state, county, and tribal elected officials describing how to provide advice and recommendations to Forest Service and BLM managers.

Rationale: A formal written agreement is expected to improve the collaborative process by specifying the terms of participation. Specifying a time period for initiating the formal agreement recognizes the importance of the collaborative process to Forest Service and BLM managers and partners. It is intended that the MOU or equivalent document would cover a geographic subregion that makes sense, such as a RAC/PAC area.

B-O60. Objective. Develop mutual learning opportunities through technology transfer and training opportunities to enhance the effectiveness of tribal involvement in agency programs.

Rationale: There are numerous mutual learning opportunities which would assist the land management agencies in implementation of agency work or programs. For example: using Interagency Personnel Agreements or offering Forest Service/BLM training to tribal people (such as federal contracting procedures/processes, how to apply for federal employment, and prescribed fire techniques/protocol); sending BLM and Forest Service employees to tribal training (such as consultation processes/protocol, tribal organization/structure, Tribal Employment Rights Office (TERO) requirements and information, and treaty seminars).

B-O61. Objective. Support federally recognized tribes' and tribal communities' subsistence needs to the greatest extent practicable. Fishing, hunting, and gathering, which all contribute to a tribe's subsistence needs, may also be reserved rights under treaty or executive order. By working with the tribes to be responsive to these social-economic considerations, we can also meet our legal obligations under federal law, policy, treaty, or executive order.

Rationale: Beyond commodity-based goods and services, federally recognized tribes have off-reservation rights and/or interests and subsistence needs which depend on the resources and lands administered by the Forest Service and BLM. The federal/tribal trust relationship is unique to federally recognized tribes and denotes a federal responsibility to tribes which is different from other governmental entities or the general public.

B-S58. Standard. When conducting or contracting work within the exterior boundaries of a federally recognized tribe's reservation, work cooperatively with the respective Tribal Employment Rights Office (TERO) and ensure knowledge of and compliance with TERO requirements.

***Rationale*:** Each tribe has a Tribal Employment Rights Office (see Appendix 8), and this office should be contacted whenever the Forest Service or Bureau of Land Management is considering conducting work within the exterior boundaries of federally recognized tribe's reservation . For example, the BLM has lands they administer which lie within the exterior boundaries of the Nez Perce Reservation. If the BLM wishes to contract for work on these lands, they must comply with the appropriate Nez Perce TERO requirements for hiring, contracting, etc. Another example of a situation where the Forest Service or BLM might conduct or contract work within a reservation is wildland fire fighting on a reservation. The TERO may require contracts with tribally owned companies for equipment, catering services, or other needs, and the agencies should work cooperatively with tribes to fight fires within and across boundaries.

B-O62. Objective. In planning and programming, minimize fluctuations in federal land management programs and activities in order to promote a more predictable operating environment for forest and rangeland related businesses.

***Rationale*:** Reducing uncertainty improves the business climate and supports greater economic vitality. It also encourages financial investments in forest- and rangeland-related services that contribute to achieving federal land management objectives. This objective reinforces that consistency in the size and regularity of land management programs and activities is important for achieving ecosystem management goals. However, additional factors outside the manager's control—such as funding levels, lawsuits and appeals, or changing conditions on or affecting nearby lands under other ownerships—also affect the predictability of the operating environment for and the outputs derived from federal forest and rangeland management programs.

B-O613. Objective. Foster compatibility of land uses and management strategies with local economic development goals through collaboration with local entities.

Rationale: Many communities have already begun the process of identifying their strengths, weaknesses, and visions of what they want to be in the future. It is desirable for the Forest Service and BLM to support these goals within the context of applicable management direction.

B-O64. Objective. While designing management activities, make commodity products available for purchase, to the extent possible: (1) to support economic activity important to rural and tribal communities and local governments, (2) to maximize regional market efficiencies, and (3) to achieve management objectives in an efficient and cost effective way. See also objective R-O35 in the Restoration management direction section.

***Rationale*:** The commercial use of Forest Service- and BLM-administered and resources can provide social, economic, and cultural benefits to society that are compatible with an ecosystem management emphasis.

B-O65. Objective. Facilitate participation of federal employees in community activities to the extent allowable under law and regulation (such as the Hatch Act). Enable federal employees to contribute leadership, planning, economic development, and other skills through involvement in their local communities.

***Rationale*:** The federal workforce is an important source of income and human capital in many communities. It is especially important to maintain or increase the participation of federal employees in community activities when communities are experiencing the effects of rapid change to their economic institutions.

B-O66. Objective. Minimize the cost to the public to participate in federal analysis and planning processes by reasonable means, such as consolidation and coordination of plans and projects within and among administrative units.

***Rationale*:** Federal efforts to implement ecosystem-based management and collaborative stewardship can lead to an increased time and financial burden on the public to participate in an increasing number of analysis, planning, and monitoring events conducted by federal agencies. A concerted effort is needed to minimize this cost of participation.

B-O67. Objective. Develop information necessary to assess effects of management actions on minority populations, low income populations, and civil rights during step-down (Subbasin Review, EAWS, or site-specific NEPA) analyses.

Rationale: The broad-scale nature of this EIS precluded identifying specific impacts on particular minority and low-income populations. This objective

highlights and reinforces the requirements to evaluate environmental justice (Executive Order 12898) and civil rights impacts (Forest Service Manual 1730 and Forest Service Handbook 1909.15, Chapter 10.15). During step-down analyses, necessary information about local and subregional low income and minority populations and their current and historical relationships to the land should be collected, along with assessments of potential impacts from Forest Service and BLM policies on these populations. This process will meet the requirements for assessing environmental justice and civil rights effects that could be discussed only in general terms in this EIS.

Federal Trust Responsibility and Tribal Rights and Interests

Description and Management Intent

Twenty-two American Indian tribes may be affected by the decisions made through the ICBEMP. The U.S. government has a trust responsibility to all of these federally recognized tribes. Additionally, these tribes have off-reservation interests within the Columbia Basin, and some have off-reservation rights reserved through treaty or executive order language (see Appendix 8). Agencies are required to manage the lands under their stewardship with full consideration of the federal trust responsibility and these tribal rights and interests, particularly reserved rights where they exist. While this project does not attempt to define the legal obligations of the BLM and Forest Service under the federal trust responsibility, the direction in this EIS relative to tribal governments reflects a commitment, whether as a legal obligation or a matter of policy, to address as fully as possible tribal concerns and interests.

Further, direction reflects consideration of federal legal responsibilities to both tribes and American Indian people as expressed through treaty language, federal laws (such as Civil Rights Act, NEPA, National Historic Preservation Act, and Native American Graves Protection and Repatriation Act), executive orders, and federal court judgements. Consultation with 22 tribal governments potentially affected by the ICBEMP decision identified a wide variety of concerns and several key issues which are held in common by those tribal governments.

Objectives and standards are found throughout this document that are responsive to the breadth of tribal issues—such as restoration of succession/disturbance regimes, habitat restoration, economics, monitoring, and other topics.

Management direction is aimed at achieving the following results in future Forest Service and BLM planning, policy, and decision-making:

1. As with other governments, a collaborative and on-going consultation process characterizes agency–tribal relations.
2. Improved government-to-government relations rely on effective collaboration and consultation, as well as agency ability to recognize common interest, to translate these sometimes different cultural values into agency ecosystem management goals and objectives, and to seek to diminish management procedural barriers.
3. Agencies' customary assessment and management actions consider and strive to respond to tribal rights and/or interests, especially with regard to off-reservation treaty rights.
4. Analysis and subsequent management decisions, including restoration activities and priorities, reflect consideration of the federal trust responsibility to affected federally recognized tribes.
5. Agency personnel recognize that indigenous, subsistence-based traditions and the rights and interests of tribes often support ecosystem management goals and can be founded upon a shared commitment to action.

Some American Indian communities within the project area exist outside reservation boundaries; some of these communities are formally administered by a federally recognized tribe, while others are not. Nothing addressed in this direction is intended to supersede or negate those legal and/or policy requirements applicable to the Forest Service and BLM.

B-O68. Objective. Establish and/or maintain a government-to-government relationship with federally recognized tribes. Consult and collaborate with affected tribes when developing and/or implementing land management decisions, actions, and/or policies that may affect the rights and interests of tribes, and/or the socio-economic well-being of tribal people. Consultation should be substantive and seek to understand and be responsive to tribal rights, concerns, and interests. Engage in cooperative activities where shared goals and mutual commitment exist.

Rationale: Federal law and policy require the BLM and Forest Service to consult with federally recognized American Indian tribes on land management actions and policies affecting the tribe(s). Because the exercise of treaty rights and tribal culture and practices are so integrally tied to lands now administered by the BLM and Forest Service, it is intended that

consultation reflect the governmental status of the tribe and consideration of the respective treaty, where it exists. Collaborative efforts are substantive when: (1) opportunities for involvement are commensurate with the governmental status of tribes, (2) there is an agency focus on being responsive (more than polite listening), and (3) the subsequent decisions/outcomes reflect agency responsiveness through results such as shared agreement or mutually identified mitigation, and agency documentation discloses how tribal concerns and issues were solicited and addressed.

B-S59. Standard. Work with tribes to develop a mutually acceptable protocol for government-to-government consultation, which ensures opportunities for effective tribal participation in decision-making, protects rights, and includes provisions for a dispute resolution process in cases of conflicts between agency and tribal positions.

B-S60. Standard. During site-specific NEPA analysis, affected tribes shall be consulted and activities shall be assessed for potential effects on tribal cultural resources. Assessments shall include traditional cultural properties and plant species of special interest to tribes. Assessments should identify and characterize tribal interests, which shall be accounted for in the decision and in implementation. Mutually acceptable procedures between tribes and agencies should be employed. Prior to proceeding with management activities, documentation shall be provided that substantive consultation on tribal interests has occurred, including any necessary mitigation.

Rationale: A list of culturally significant plant species is included in Appendix 8. This list is meant to serve as a starting point for collaborative discussion with the tribes, since the species listed may not occur in all areas of the project area or may not be used by all tribes.

B-S61. Standard. Initiate agreements with tribal governments specifying repatriation procedures in conformance with Native American Graves Protection and Repatriation Act (NAGPRA) and consultation procedures regarding federal compliance with NAGPRA, National Historic Preservation Act, and Archaeological Resource Protection Act.

B-S62. Standard. Where tribes regulate hunting, fishing, gathering and grazing activities of tribal members, acknowledge and be aware of tribal management efforts and work cooperatively with tribes and states.

B-S63. Standard. Affected American Indian tribes shall be consulted on any land ownership adjustments (exchange, consolidation, and/or disposal) of Forest Service- or BLM-administered lands. This consultation should occur prior to any public scoping announcement and before any lands/parcels have been formally agreed upon for inclusion in a proposal or action. Tribes should also be considered as a possible partner for land tenure adjustment opportunities, particularly when such lands are within their ceded lands/territories.

Rationale: Federally recognized tribes have interests on lands administered by the Forest Service and BLM. Additionally, those tribes with reserved rights under treaty or executive order exercise those rights on public lands. Typically, standard fair market appraisals do not consider treaty values. If public lands should be exchanged, sold, or otherwise disposed of, then tribes need to be made aware of the resources involved and the effect of the land adjustment, if any, on the exercise of their tribal rights and interests.

B-O69. Objective. Better understand and incorporate into federal land management how places are valued by American Indians. (See Chapter 2 discussion of Sense of Place.)

Rationale: Different place attachment distinctions are recognized by traditional American Indian communities and tribes compared to those recognized by the general public. These differences in place attachments are in part based on: (1) the greater length of time native cultures have spent in the project area; (2) the greater degree place attachments have been integrated into their culture systems of religion, economy, politics, and social / kinship; and (3) cultural values, histories, and relationships to land, which vary from mainstem American culture and are typically not understood by the general public. Also, some cultural place information may be inappropriate for public dissemination. This can be addressed by developing a separate section in place assessments for American Indian groups.

B-S64. Standard. When conducting Subbasin Review and/or EAWS, tribal participation shall be solicited and collaboration with affected American Indian tribes undertaken to identify resources and places of value. This assessment should provide for tribal participation and be commensurate with the analysis conducted to consider resources and places identified by other intergovernmental entities at this scale.

B-O70. Objective. Solicit and recognize the legitimacy and contribution of tribal tradition-based knowledge and expertise when collaborating with affected tribes. Use this knowledge to inform agency planning and decision-making processes.

Rationale: Tribes have unique knowledge and expertise gained through generations of oral history and cultural teachings. It can contribute to agency understanding of resource values, the history of a place, and the uses that are occurring or have occurred over time. This tradition-based knowledge can be critical to the agencies' understanding of, and response to, the rights and interests of federally recognized tribes. It can also contribute to the agencies' ability to appropriately honor their trust responsibility. When a product or service is needed by the agencies involving this type of information, it might be appropriate to compensate or contract with an affected tribe for it.

Management Direction — Restoration

Description and Management Intent: Overall

Restoration needs are diverse, intensive, and widespread in the interior Columbia Basin. In the landscape dynamics context, individual ecosystem components (such as aquatic and riparian areas, rangelands, or forestlands) and succession/disturbance regimes are in need of restoration. Although restoration of individual components will contribute to long-term needs, restoration of any one component will be less effective in the long term if the other components are not also in good health and if succession/disturbance regimes are not intact. Restoration should be accomplished in an integrated fashion to benefit aquatic and terrestrial species, forest health, rangeland health, and watershed health, as well as for economic, tribal, and other needs of society.

Restoration management direction is intended to be applied wherever restoration activities occur—whether based on local or broad-scale priorities.

Restoration management direction is intended to be applied wherever restoration activities occur—whether based on locally identified, broad-scale functional (one resource), or broad-scale integrated restoration priorities (see following discussion). Development of the restoration management strategy is described more fully in Appendix 15.

Locally Identified Priorities: Restoration will proceed in areas that are locally identified as priorities for restoration, as is the case currently. ICBEMP restoration direction is intended to be applied where the appropriate conditions occur and where local administrative units have prioritized their restoration activities. ICBEMP restoration direction focuses on broad-scale issues that cross more than one administrative unit, yet are applicable within individual administrative units if the appropriate conditions are found.

Broad-scale Functional Restoration Priorities: Six maps portray various components of the Interior Columbia Basin and its ecosystems, including landscape (Map 3-2), aquatic (Map 3-3), water quality (Map 3-4), old forest/rangeland habitat (Map 3-5), economic (Map 3-6), and tribal (Map 3-7). They were developed to assist administrative units by providing broad-scale context during Subbasin Review to assist in stepping-down broad-scale recommendations for restoration priorities to prioritize local restoration activities. This is done by highlighting those subbasins that have numerous functional (single resource) restoration priorities and good opportunity for restoration to be achieved through Forest Service and BLM management actions. These maps are also intended to provide information for Forest Service regional and BLM state offices in order to influence budget planning.

Broad-scale High Restoration Priority Subbasins for Alternative S2: *Subbasins that are identified as* broad-scale high restoration priority *are shown on Map 3-8. This map was derived from the broad-scale functional restoration priority maps (Maps 3-2 through 3-7). The intent for the high restoration priority subbasins is to concentrate restoration efforts (such as aquatic, water quality, vegetation management, reestablishing fire), and to make restoration activities more effective and efficient. Identification of these subbasins was based on: risk to aquatic and terrestrial species and their habitats from natural disturbances; opportunity to reduce those risks, improve habitats, provide the appropriate mix of habitats, and fix succession/disturbance regimes; ability to provide connectivity for and expand scarce aquatic and terrestrial habitats; hydrologic processes; economic value to human communities; and ability to restore other biophysical*

and/or social needs where opportunities exist. Additional aquatic priority subbasins were included to expand and improve extent, condition, and connectivity of aquatic habitat. These priorities were determined from a broad-scale perspective to identify multiple restoration opportunities that would also be responsive to variable funding levels.

Broad-scale High Restoration Priority Subbasins for Alternative S3: *Subbasins that are identified as* broad-scale high restoration priority *are shown on Map 3-9. This map was derived from the broad-scale functional restoration priority maps (Maps 3-2 through 3-7). The intent for the high restoration priority subbasins is to concentrate restoration efforts (such as aquatic, water quality, vegetation management, reestablishing fire) in subbasins near isolated, economically specialized communities, and to make restoration activities more effective and efficient. Identification of these subbasins was based on: risk to aquatic and terrestrial species and their habitats from natural disturbances; opportunity to reduce those risks, improve habitats, provide the appropriate mix of habitats, and fix succession/disturbance regimes; ability to provide connectivity for and expand scarce aquatic and terrestrial habitats; hydrologic processes; and economic value to human communities. These priorities were determined from a broad-scale perspective to identify multiple restoration opportunities that would also be responsive to variable funding levels, prioritizing actions in subbasins near or containing isolated, economically specialized communities.*

However local restoration priorities are set, management direction related to succession/disturbance regimes and other aspects of landscape restoration is intended to provide the foundation for other restoration activity. Therefore, landscape restoration management direction is presented first in this section. Terrestrial source habitat restoration management direction follows, focusing on the vegetation cover types and structural stages that have declined substantially in geographic extent from the historical to the current period. *(NOTE: unless otherwise specified, source habitat discussions refer to all 12 Terrestrial Families.)* Water quality restoration and aquatic habitat needs are addressed next. Direction related to social and economic considerations, including tribal aspects, is provided to highlight areas where restoration activities have a direct influence on human community economic and social needs.

Restoration in all cases is intended to be consistent with direction for aquatic (A1 or A2) subwatersheds; terrestrial (T) watersheds; riparian areas; and threatened, endangered, and proposed species habitat. Some federally listed species have approved recovery plans, which identify specific recovery actions, some of which are oriented toward improving habitat condition on Forest Service- and BLM-administered lands. Consistent with standard B-S31, restoration management activities are intended to be tiered to these approved recovery plans where applicable.

Landscape Restoration

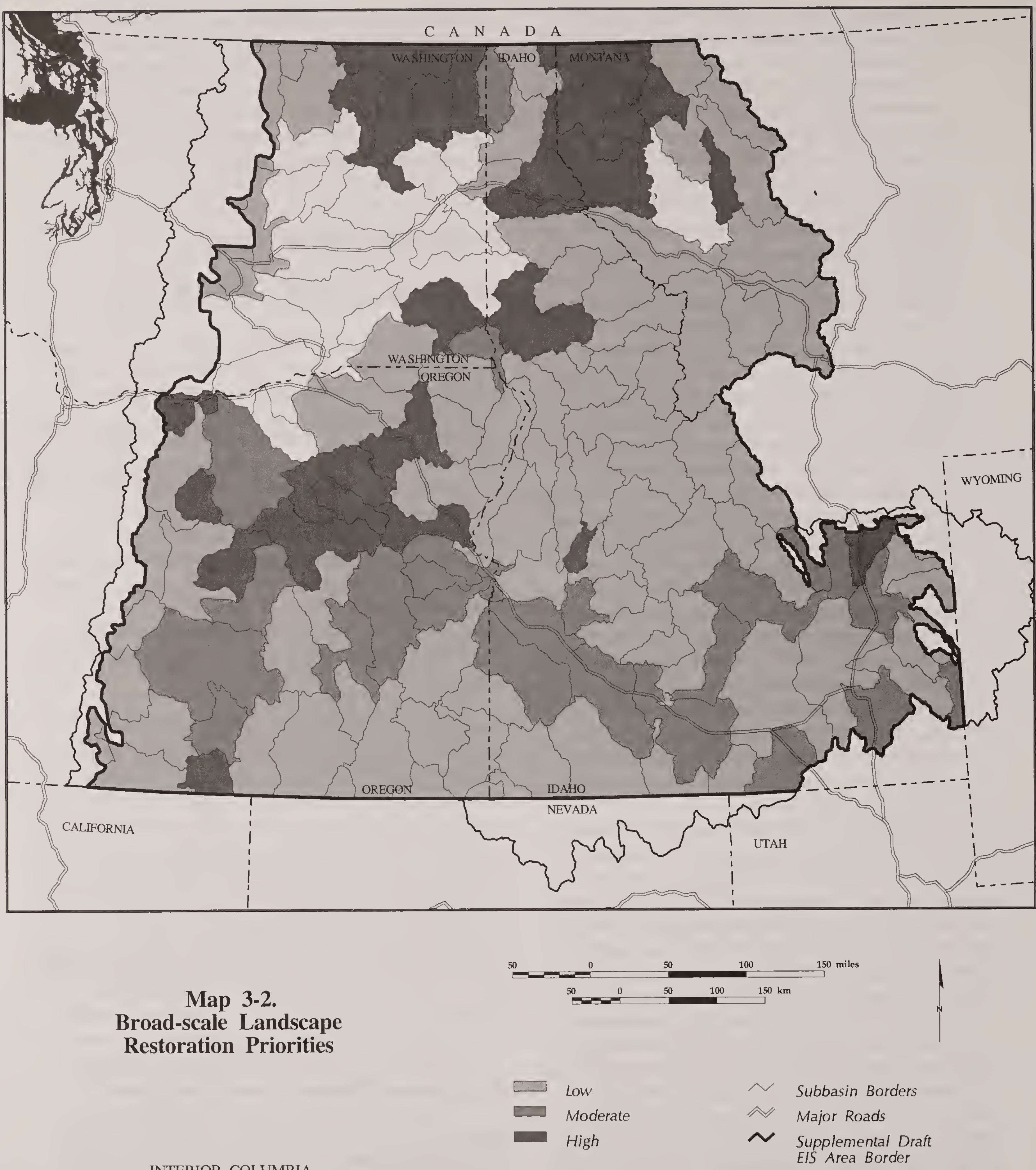
Description and Management Intent

The restoration of landscape succession/disturbance regimes is the foundation of the strategy to manage long-term risk to aquatic and terrestrial species. The intent of landscape restoration direction is to repattern vegetation patches and succession/disturbance regimes and to restore watersheds and streams to a condition more consistent with landform, climate, and biological and physical characteristics of the ecosystem. Such restored ecosystems will be more resilient to disturbances, more predictable, and will provide the range of habitats needed by aquatic and terrestrial species. This risk management strategy conserves scarce habitats in the short term while expanding these habitats through restoration in the long term.

Landscapes are healthy when their intertwined components and processes are functioning properly, in the context of the desires and needs of society. Individual components and processes are woven together by the thread of succession/disturbance regimes (such as fire, flood, windthrow, insects, and disease) and processes (such as the flows and cycles of energy, nutrients, and water). Intact succession/disturbance regimes provide for terrestrial and aquatic habitats, intact hydrologic processes, and the continuous and predictable flow of products and land uses. These landscape considerations and their dynamics are the cornerstones of landscape health.

Ecosystem Processes and Functions

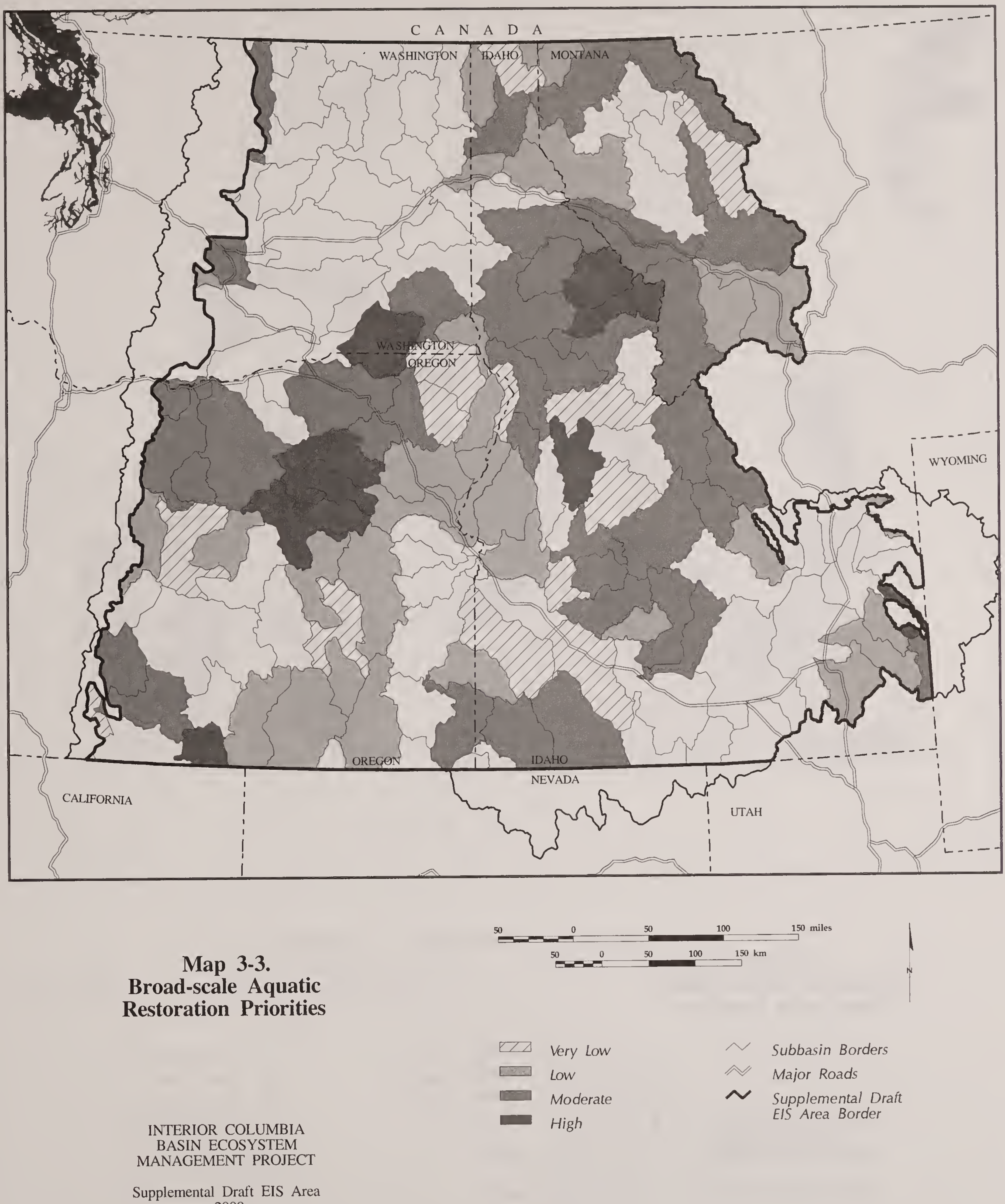
R-O1. Objective. Consolidate and coordinate restoration activities to the extent possible, where multiple needs can be addressed relative to aquatic health, riparian processes and functions, forest health, rangeland health, recovery and redistribution of source habitats, water quality, recovery of succession/disturbance regimes, and socio-economic and tribal needs. Look for situations where there are multiple benefits—that is, where the landscape components can be restored for the benefit of short- and long-term



**Map 3-2.
Broad-scale Landscape
Restoration Priorities**

INTERIOR COLUMBIA
BASIN ECOSYSTEM
MANAGEMENT PROJECT

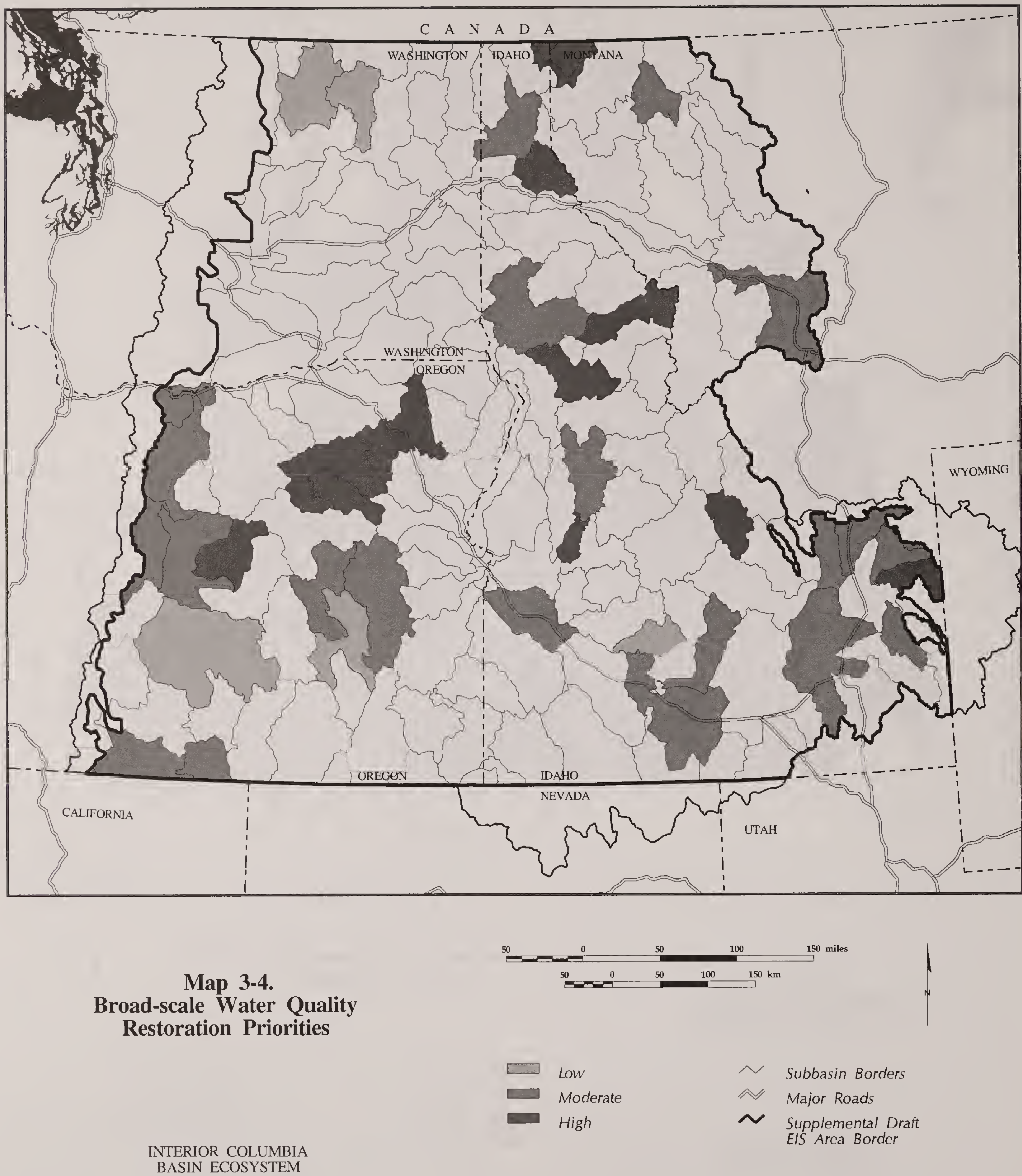
Supplemental Draft EIS Area
2000



**Map 3-3.
Broad-scale Aquatic
Restoration Priorities**

INTERIOR COLUMBIA
BASIN ECOSYSTEM
MANAGEMENT PROJECT

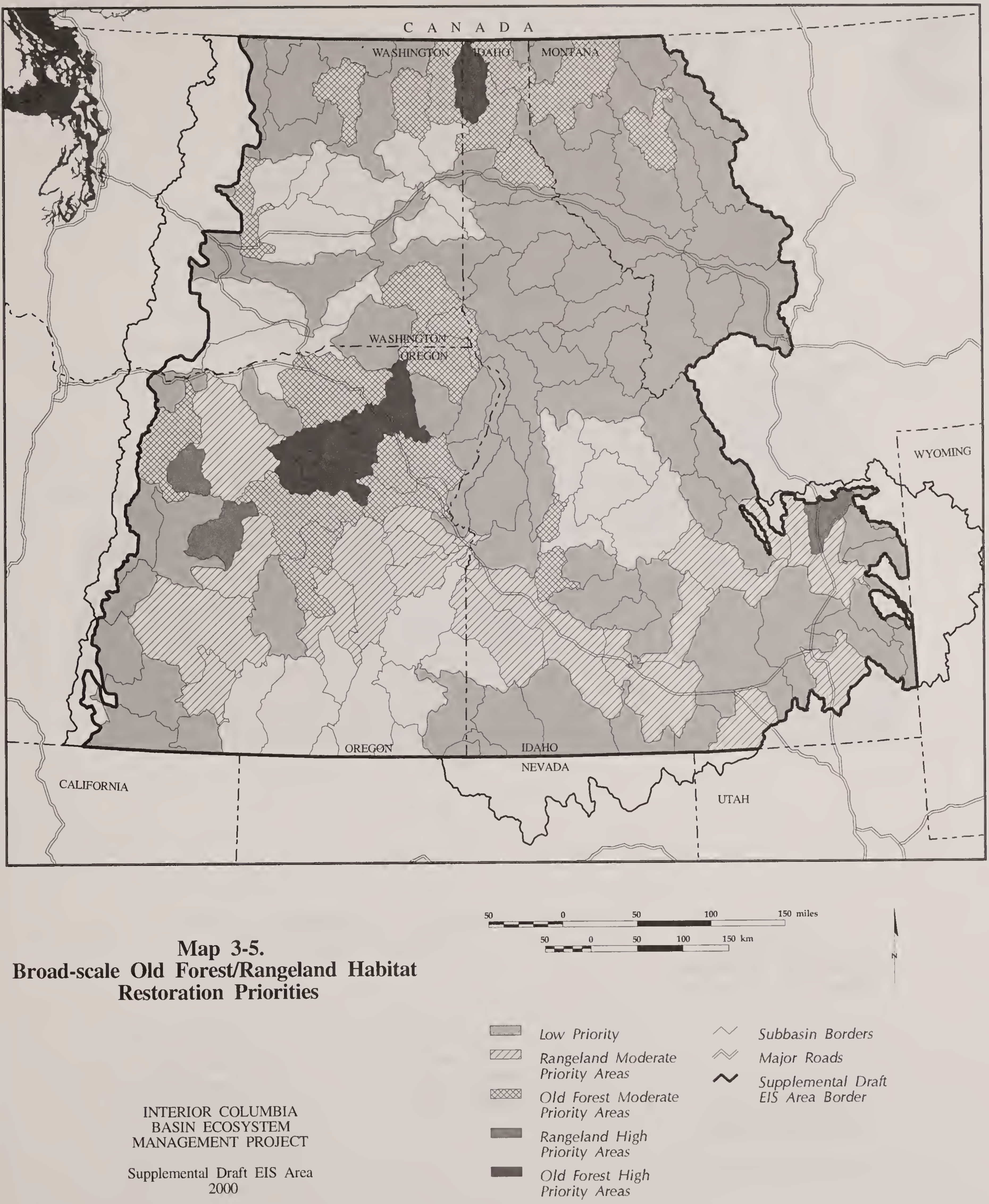
Supplemental Draft EIS Area
2000



Map 3-4.
Broad-scale Water Quality Restoration Priorities

INTERIOR COLUMBIA
BASIN ECOSYSTEM
MANAGEMENT PROJECT

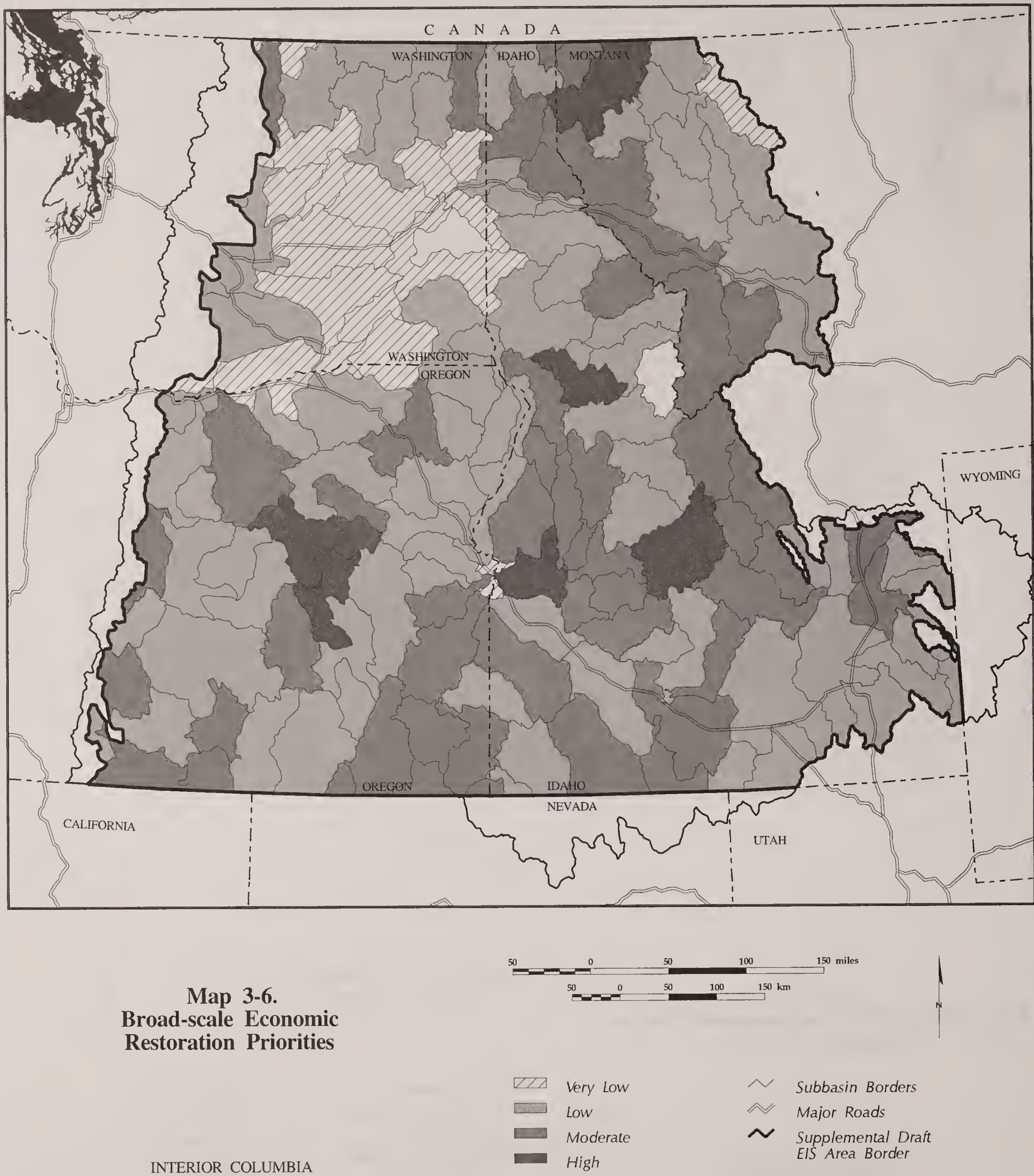
Supplemental Draft EIS Area
2000



Map 3-5.
Broad-scale Old Forest/Rangeland Habitat Restoration Priorities

INTERIOR COLUMBIA
BASIN ECOSYSTEM
MANAGEMENT PROJECT

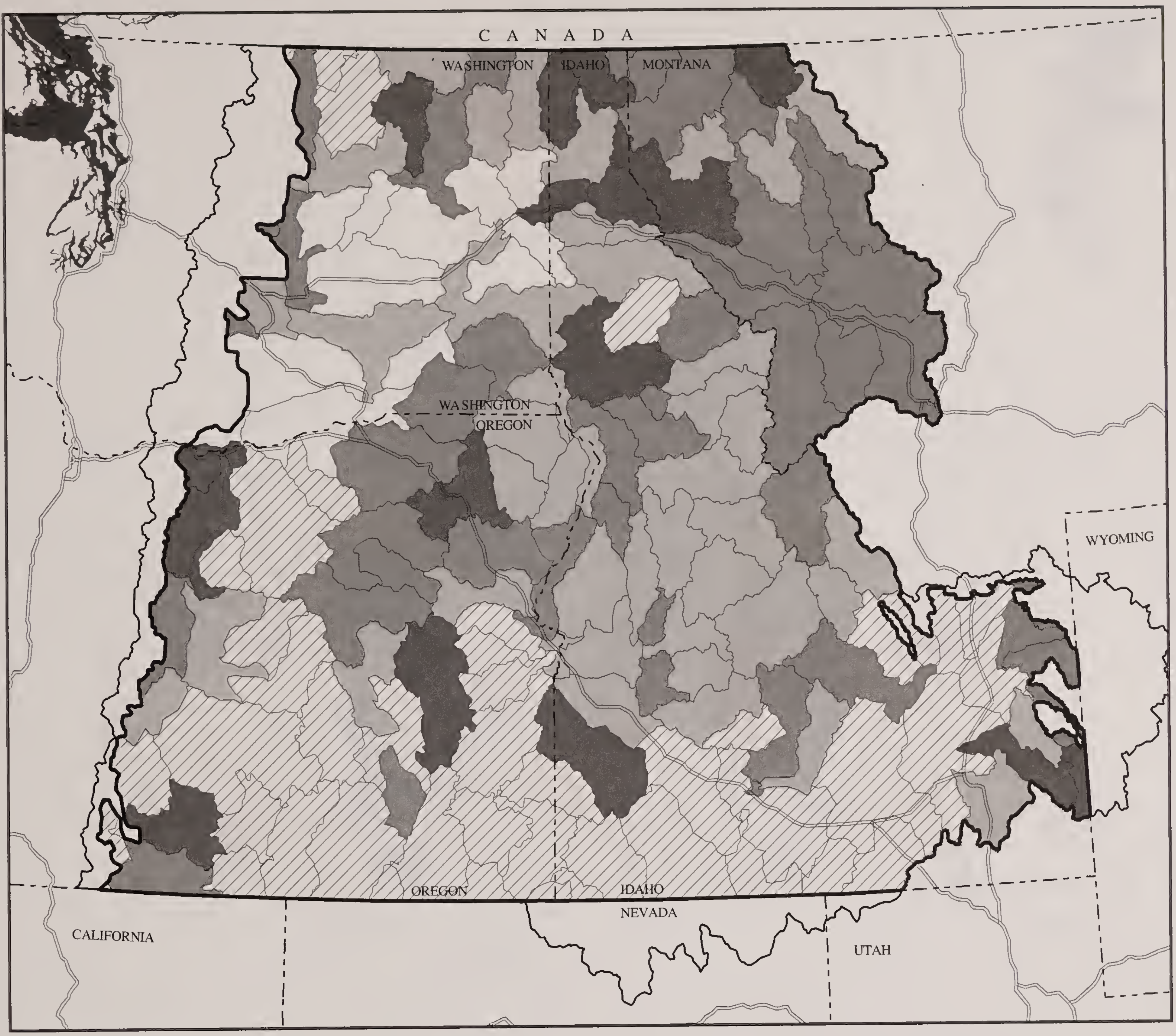
Supplemental Draft EIS Area
2000



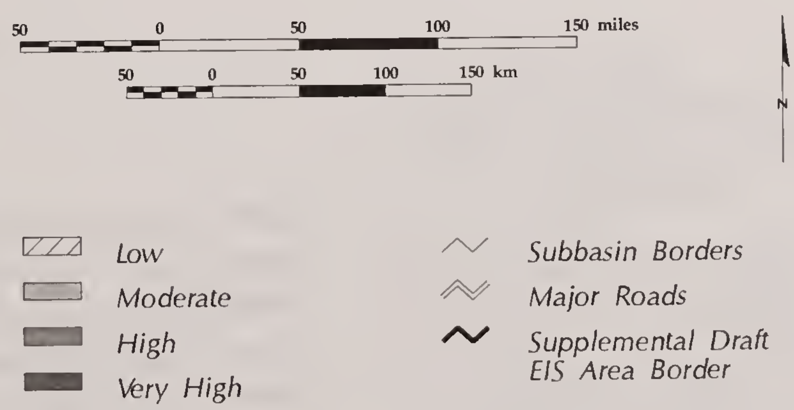
Map 3-6.
Broad-scale Economic Restoration Priorities

INTERIOR COLUMBIA
BASIN ECOSYSTEM
MANAGEMENT PROJECT

Supplemental Draft EIS Area
2000



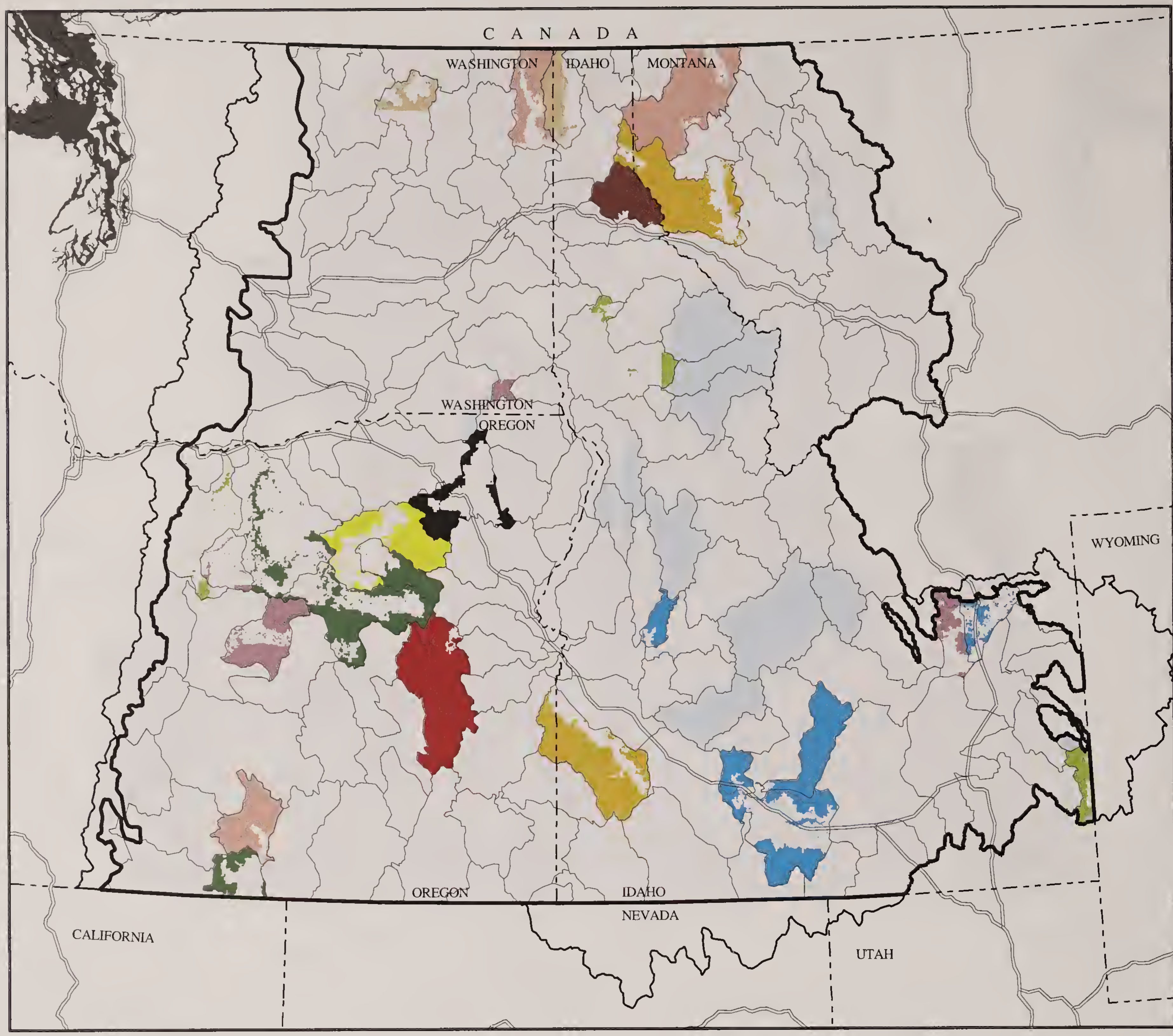
Map 3-7.
Broad-scale Tribal Restoration Priorities



INTERIOR COLUMBIA BASIN ECOSYSTEM MANAGEMENT PROJECT

Supplemental Draft EIS Area
2000

Alts S2 & S3 - Restoration



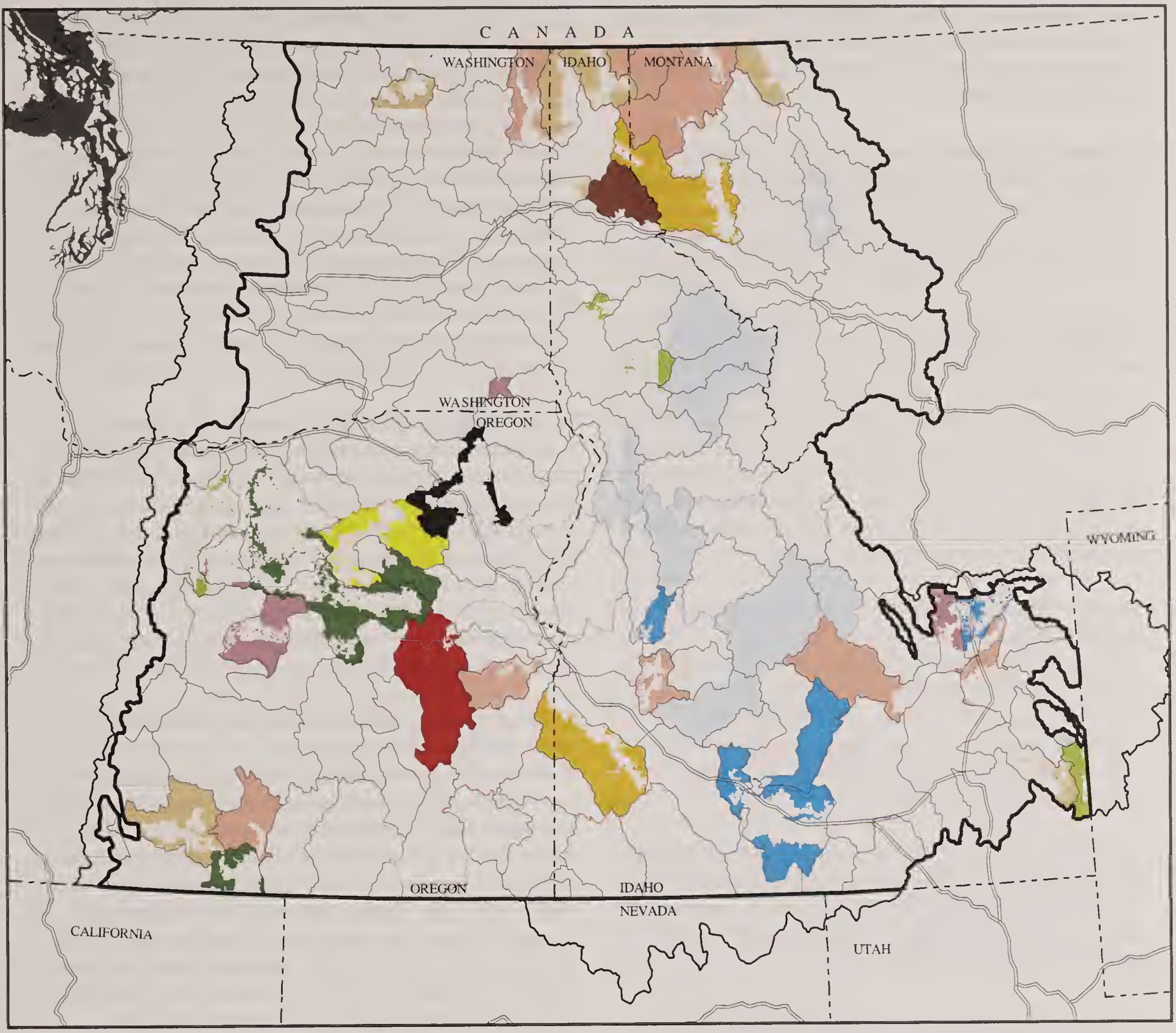
**Map 3-8.
Broad-scale High Restoration Priority Subbasins: Alternative S2**

BLM- and Forest Service-Administered Lands Only

INTERIOR COLUMBIA BASIN ECOSYSTEM MANAGEMENT PROJECT

Supplemental Draft EIS Area
2000

- Biophysical, Economic, Tribal, Aquatic
- Biophysical, Economic, Tribal
- Biophysical, Economic, Aquatic
- Biophysical, Tribal, Aquatic
- Biophysical, Economic
- Biophysical, Tribal
- Biophysical, Aquatic
- Economic, Tribal
- Tribal, Aquatic
- Biophysical
- Economic
- Tribal
- Aquatic
- Subbasin Borders
- Major Roads
- Supplemental Draft EIS Area Border



Map 3-9. Broad-scale High Restoration Priority Subbasins: Alternative S3

BLM- and Forest Service-Administered Lands Only

INTERIOR COLUMBIA BASIN ECOSYSTEM MANAGEMENT PROJECT

Supplemental Draft EIS Area
2000

- Biophysical,Economic,Tribal,Aquatic
- Biophysical,Economic,Tribal
- Biophysical,Economic,Aquatic
- Biophysical,Tribal,Aquatic
- Biophysical,Economic
- Biophysical,Tribal
- Biophysical,Aquatic
- Economic,Tribal
- Tribal,Aquatic
- Biophysical
- Economic
- Tribal
- Aquatic
- Subbasin Borders
- Major Roads
- Supplemental Draft EIS Area Border

landscape health, diversity, and species viability, and where economically specialized and/or isolated communities can be provided economic and employment opportunities.

Rationale: Although much of the project area is in need of restoration, budgets preclude completing all of it in the near future. Concentrating efforts in localized areas (subbasins), rather than spreading scarce resources thinly across the project area, will be most cost effective and have the greatest positive impact in the project area. The timing of restoration activities (for example, first using existing roads to restore the uplands then removing the roads after the upland restoration is complete) makes efficient use of existing features. Coordinating restoration efforts as they are being designed and planned saves time and money in the end. Prioritizing restoration where it is needed and where it has the potential to benefit communities ensures that both facets of the Need statement (in Chapter 1) are addressed.

R-O2. Objective. Restore vegetation patches, patterns, structure, and species composition to be more consistent with the landform, climate, and biological and physical characteristics of the ecosystem, and to provide source habitat for terrestrial species. Manage disturbances to make vegetation patterns more consistent with their location on the landscape.

Rationale: Restoring the following potential vegetation groups to be consistent with the landform, climate, and biological and physical characteristics of the area will establish source habitats where they have declined historically:

In *dry forests*, ridges, terraces, and plains typically supported late seral single story stands of shade-intolerant species. In some places in dry forests of the project area, Douglas-fir acts like the shade-intolerant species. Where this occurs, this objective would apply to Douglas-fir. On easterly, westerly, and southerly slopes, there typically would be predominantly late seral single story forests of shade-intolerant trees mixed with small, early seral and mid seral patches. North slopes, draws, and riparian zones typically supported a mixture of shade-tolerant and shade-intolerant species in either early, mid, or late seral stage and multi-story old-forest structure (Hann, Jones, Karl, et al. 1997). Frequent low intensity fire is an important ecological maintenance process in dry forest.

In *moist forests*, it is desirable to restore benches, terraces, or ridges first because there is likely to be the most restoration potential there. These areas on the landscape have the greatest departure from natural conditions of the moist forest and therefore have the greatest need of restoration. Once restored, they can be maintained relatively easily. The goal is to remove many of the shade-tolerant trees and fuel ladders and give growing space to the larger trees, especially western white pine, western larch, and ponderosa pine. The result should be a single story structure which could be maintained through future burning and/or thinning. Creation of openings in forests will be needed to get white pine or larch back onto the landscape. On mountain slopes, it is appropriate to let much of the moist forest remain in a multi-story old forest structure with a larger component of shade-tolerant species. The patch and pattern should fit the landscape and the historical disturbance regime.

In *cold forests*, much of the landscape has become more homogenous because of either large fires or lack of fire. Timber harvest, prescribed fire, and "wildland fire use for resource benefit" (previously referred to as prescribed natural fire) create patches and patterns on the landscape that are more consistent with landform, climate, and biological and physical characteristics of the ecosystem. However, it is intended that appropriate proportions of the landscape be kept in early, mid, and late seral stages.

Most of the *dry grass* loss to date has been through conversions to agricultural cropland and pastureland, and to urban development; however, the rate of these conversions has slowed substantially since most of the farmable lands already have been converted. Currently the biggest concerns in the dry grass potential vegetation group are conifer encroachment and exotic plant invasions. Restoration efforts in the dry grass group are intended to focus on bringing fire back into the system, to reduce conifer encroachment, and to reduce or eliminate the spread of noxious weeds and other exotic plants. However, caution must be exercised when bringing fire back into the system since fire may enhance the opportunity for noxious weed establishment; noxious weed control measures may need to be part of any fire treatment.

Most of the *dry shrub* loss was a result of agriculture and urban development, similar to dry grass. Currently, the invasion of exotic plants is the most significant concern. Restoration efforts are intended to be tied to reducing and eliminating the spread of noxious weeds and implementing livestock grazing systems that are conducive to improving dry shrub conditions.

Cool shrub loss also was due to agricultural and urban development. Currently the encroachment of Douglas-fir and juniper is the most significant concern. Restoration efforts are intended to be tied to controlling these species and returning the historical fire regime to the cool shrub potential vegetation group.

In *riparian herbland, shrubland, and woodland areas,* much of the area has been altered by activities such as excessive grazing pressure, road construction, and/or timber harvest. Initially, the highest priority is restoration of riparian habitat, processes, functions, and connectivity. Restoration efforts are intended to focus on increasing diversity and improving structure of riparian vegetation, banks and bank stability, width and depth ratios, limiting or managing the impacts of noxious weeds, improper grazing, roads, and timber practices. Restoration efforts in riparian areas are designed to provide minimum risk to riparian and aquatic values in comparison to restoration efforts in other areas.

R-G1. Guideline. Priority should be given to restoring whole hydrologic units if resources are available and if the land base provides the opportunity. Consider completing restoration treatments within five years. Avoid reentry for a duration that approximates the time interval between natural disturbance events.

R-G2. Guideline. To promote development of late seral single layer ponderosa pine, consider using thinning, harvesting, and/or prescribed fire on existing mid seral forest structural stages. Stand structure, condition, composition, density, fuel loading and arrangement, and litter and duff depth may be matched to the desired fire regime. The success of sustaining shade-intolerant tree species would depend on recurring disturbance.

R-G3. Guideline. Consider using the existing road network for access to do restoration activities before removing roads in watersheds where vegetation restoration is a priority.

R-O3. Objective. Individual or collective upland restoration management actions that alter the vegetation composition (such as prescribed burning, weed control, thinning, and seedings) should:

a. Retain or promote infiltration, permeability, and soil moisture storage;
b. Minimize soil loss and sediment delivery that is in excess of natural disturbance processes;
c. Maintain or restore nutrient cycling and energy flow;
d. Maintain and restore water quality;
e. Minimize the increase and spread of noxious weeds, above the inherent increase and spread of noxious weeds by natural disturbances (such as wildfire);
f. At the subbasin scale (or groups of subbasins), contribute to the diversity (distribution and abundance) of (1) native plant cover types and structural stages (source habitats); and (2) native plant and animal species and, if natives cannot be restored, desired non-native plant and animal species;
g. Support the conservation of threatened, endangered, proposed, candidate, and sensitive species through source habitat restoration; and
h. Be followed up with land use management that maintains the restored conditions.

Rationale: This objective is adapted from the standards for rangeland health and guidelines for livestock grazing management (Healthy Rangelands Initiative), which are currently being implemented by the BLM. It has been modified to apply to both forested lands and rangelands. It is a comprehensive, basin-wide objective, which is consistent with both the aquatic and terrestrial habitat portions of the ecosystem management strategy. *"Individual or collective upland restoration management actions"* is meant to accommodate situations where more than one management action, in sequence, might be required to accomplish restoration. For example, herbicide weed control followed by seeding, or pre-scribed burning followed by weed control.

Bullets "a–c": Changes have taken place in soils, biomass storage, energy flows, and net primary productivity because of changes in succession/disturbance regimes and vegetation structure and composition. In order to restore and maintain soil productivity and nutrient cycling, and to have sustainable vegetation growth and vigor, soils need to continue to develop under conditions similar to those with which they originated.

Bullet "e": In some instances, upland restoration actions, such as prescribed burning, can encourage noxious weed spread. Subsequent weed control would help prevent or minimize the increase and spread of noxious weeds. Therefore, although prescribed burning in itself might contribute to noxious weed increase and spread, the intent of this objective is not to prohibit prescribed burning if it is combined with subsequent weed control.

Bullet "f" is written to focus on both plant community (cover type–structural stage combination) diversity and species diversity. The intent is for upland restoration to perpetuate the existence and development of native plant cover types and structural stages (terrestrial source habitats), and native and desired non-native species, minimizing their loss across and within landscapes. The intent is <u>not</u> to conduct upland restoration management actions to achieve as much diversity as possible regardless of climate,

landform, soils, and succession-disturbance regimes; such an approach could lead to undesirable fragmentation of native plant cover types and structural stages due to reductions in patch size. Bullet "f" focuses diversity at the scales of subbasin or groups of subbasins, which is consistent with the broad-scale nature of ICBEMP, the broad-scale vegetation data developed through the ICBEMP, and fostering connectivity of plant and animal habitats across the project area. The expectation is that each administrative unit will manage cover type and structural stage diversity at watershed, subwatershed, and finer scales, resulting in diversity at the scale of subbasin or groups of subbasins.

Bullet "h" is intended to prevent "backsliding" of resource conditions after improvements from restoration. For example, if excessive historical livestock grazing pressure contributed to the increased density of western juniper, prompting the need for upland restoration (such as prescribed burning), then the intent is that livestock grazing management following the burn would be consistent with maintaining the new desired conditions as a result of the prescribed burning. (In other words, grazing should not increase the density of juniper in the future.)

R-G4. Guideline. Consider areas used by species such as sage grouse, sharptailed grouse, and mountain quail as a high priority for conversion of exotic monocultures to native shrublands. Especially consider such areas in the Upper Snake and Lower Snake Resource Advisory Council (RAC) areas (see Map 2-1).

R-G5. Guideline. Consider the following when seeding altered sagebrush steppe and other areas:

- oils and precipitation;
- Availability of local native seed;
- Ability of seeded species to compete with exotic annuals;
- Long-term success of seeded species meeting objectives;
- Risk of failure;
- Meeting biodiversity and wildlife needs;
- Not creating monocultures;
- Fragmentation and patch-size issues;
- Planting and regeneration of shrub species.

R-G6. Guideline. Consider laying out vegetation manipulation projects over a large enough area so that livestock and wildlife use will not be concentrated in one area.

R-O4. Objective. Use an integrated mix of restoration activities to repattern succession/disturbance regimes and achieve sustainable landscape conditions. Prioritize and use management activities appropriate for the management emphasis of an area (such as wilderness-type areas, aquatic A1 and A2 subwatersheds, terrestrial T watersheds, and high restoration priority subbasins), and placement on the landscape (such as within the dry forest or cool shrub potential vegetation group), during the appropriate step-down process (programmatic planning, Subbasin Review, EAWS, or site-specific NEPA analysis).

Rationale: *Restoration activities* include: silviculture, rangeland management, noxious weed control, reduction of adverse road effects, prescribed fire, and aquatic/ hydrologic restoration. To reduce further fragmentation of the landscape, priority should be given to restoring whole hydrologic units if resources are available and if the land base provides the opportunity. The most effective types and mix of restoration activities will vary depending on the emphasis or priority of an area, which depends on the management intent and management direction. For example, restoration activities in an A2 subwatershed would probably focus on aquatic/hydrologic restoration and reduction of adverse road effects, whereas restoration in low and mid-elevation old forest might include silivicultural techniques and prescribed fire to accelerate the old forest characteristics of the area. Appendix 14 describes the types of activities that could be most effective in areas with different emphases or priorities, including wilderness-type areas, A1 and A2 subwatersheds, T watersheds, urban–rural–wildland interface areas, and high restoration priority subbasins.

R-O5. Objective. Reduce the risk from wildland fire in urban–rural–wildland interface areas. Where there is risk to human life and property from wildfire, reduce heavy fuel levels, flash fuels, ladder fuels and connectivity among crowns in the dominant vegetation layer.

Rationale: There are urban–rural–wildland interface areas at moderate and/or high risk from wildfire in all the RAC/PAC areas. A priority in these areas is fuels reduction through prescribed fire, silviculture, livestock grazing, and other methods of vegetation management, either alone or in combination (for instance, thinning or brush control prior to prescribed burning). Fuels reduction should decrease the likelihood for loss of life or damage to property from wildfires.

R-O6. Objective. Sustain hydrologic processes characteristic of the geoclimatic settings through management actions that resemble effects of natural

disturbance processes. Hydrologic processes critical for balanced landscapes/ecosystems include, but are not limited to, stream flows and sediment in channels.

Rationale: Broad-scale geoclimatic settings influenced by time and disturbances produce landforms, soils, and vegetation with inherent variability in performance elements such as stream channel form, large wood, stream flow and sediment regimes. *Stream flow regimes* include timing, magnitude, duration, and spatial distribution of peak, high, and low flows. *Sediment regimes* include timing, volume, rate, and character of sediment input, storage, and transport. Characteristic stream flows (including floodplain inundation and water table elevation) and sediment regimes are essential to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing.

R-G7. Guideline. Consider the spatial and temporal role of natural disturbances within uplands and riparian areas when planning restoration of hydrologic processes. Consider vegetation management practices that are compatible with the spatial and temporal disturbance processes and patterns to restore hydrologic processes that are representative of the geoclimatic setting.

R-O7. Objective. Restore and maintain flow regimes sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing. Flow regimes include timing, magnitude, duration, and spatial distribution of peak, high, and low flows.

R-O8. Objective. Restore and maintain the timing, variability, and duration of floodplain inundation and water table elevation.

R-O9. Objective. Provide distribution, diversity, and complexity of watershed and landscape-scale processes to restore and maintain aquatic and riparian systems and species, populations, and communities.

Native Species and Biological Crust

R-O10. Objective. Restore the native grass, forb, and shrub composition within the sagebrush and shrub steppe cover types (source habitat for Terrestrial Family 11). Reclaim areas from cheatgrass monocultures in these cover types and slow the spread of non-native species.

Rationale: Native plant abundance, frequency, and vigor in the big sagebrush cover type have changed significantly from historical times on federal lands because of the invasion of annual grasses, especially cheatgrass, and other exotic plants. Restoration of ground cover, diversity, and site productivity is critical to the health of the rangeland ecosystem. Some cover types (big sagebrush, salt desert shrub) when under stress or disturbed by drought, fire, excessive grazing pressure, or other factors provide the opportunity and place for these invasive exotic plants to become established. Once established, biodiversity is diminished and wildfire frequency increases. This reduces the structure and quality of habitat for sagebrush-dependent and other terrestrial species. Winter ranges for species such as deer, elk, and sage grouse are typically in lower elevation areas, normally in big sagebrush or salt desert shrub cover types. Restoration of the structure and quality of habitat in these cover types is critical to the persistence of wildlife species that depend on them.

R-S1. Standard. Native species or cultivars shall be used for seedings and plantings unless native species are not capable, available, or cost effective in maintaining or achieving objective R-O10.

Rationale: The intent of this standard is to require the use of native plants or cultivars whenever the need arises for seeding or planting to meet objective R-O10. However, it is understood that circumstances may make this requirement infeasible. These circumstances include: areas where planting native species is not feasible or will not achieve the objective (for example, low precipitation areas such as salt desert shrub or possibly areas of exotic plant infestations); when native seeds or seedlings are not in sufficient quantities to achieve the objective; or when the cost of native seed or seedling purchase is beyond the funding available for the activity.

R-G8. Guideline. Consider emphasizing native seeds or seedings that can be obtained from local genetic stock to prevent the introduction of genetic material that may not be adapted or appropriate for local conditions.

R-O11. Objective. Manage land uses and reduce the extent of exotic plant invasions to allow the restoration of biological crust (microbiotic crust) development where potential for biological crust development is high. Focus priority within the salt desert shrub cover type, Wyoming big sagebrush portion of the big sagebrush cover type, and low sage cover type (source habitats for Terrestrial Families 11 and 12) where site-specific features such as soil texture, vascular plant cover, and precipitation pinpoint high potential for biological crust development.

Rationale: Biological crust development in the salt desert shrub cover type, Wyoming big sagebrush portion of the big sagebrush cover type, and low sage cover type (which have been altered by recreational

activities, excessive livestock grazing pressure, or exotic undesirable plant invasions) can be integral to restoration of rangeland health and restoration of terrestrial source habitats for species such as pygmy rabbit, sage grouse, and mule deer. Biological crusts play many ecological roles, particularly on low precipitation sites with limited vascular plant cover where there is high potential for biological crust development. Some of these roles include: (1) protection of soil surfaces from erosion from wind and water (soil stability), (2) nutrient cycling, (3) facilitating native perennial species establishment and (4) hindering establishment of exotic undesirable species such as cheatgrass and medusahead (Hann, Jones, Karl et al. 1997; Wisdom et al. in press).

High potential for biological crust development exists within the salt desert shrub cover type, drier portions of the big sagebrush cover type (such as Wyoming big sagebrush), and the low sage cover type. However, a site-specific evaluation of potential biological crust development should be performed because the degree of biological crust development within these and other cover types depends on factors such as soil texture, amount of vascular plant cover, precipitation, and other factors.

An existing, draft biological crust evaluation developed by the BLM-Idaho State Office (Kaltenecker, Rosentreter, and Pellant 1999; see Appendix 13) may be used at site-specific scales to pinpoint (1) where there is high potential for biological crust development within these three cover types and other cover types, and (2) under what conditions biological crust development is affected by land uses (such as livestock grazing and recreation). It is expected that this or a similar evaluation method would be conducted during existing rangeland assessments such as rangeland health assessments (meeting Healthy Rangelands standards and guides). However, assessments could also be conducted during field work for allotment or geographic area evaluations, or during any other anticipated field surveys or assessments. It is not the intent of this objective to require administrative units to assess rangelands solely to determine the potential for biological crusts.

R-G9. Guideline. Consider modifying season of use to avoid trampling of biological crusts in the dry season in areas where biological crusts exceed 10 percent of the potential ground cover.

R-G10. New Guideline. Consider defining and scheduling spring and fall grazing at the fine scale to reflect actual soil moisture conditions to avoid severe disturbance of biological crust when soils are extremely dry.

Road Restoration

Description and Management Intent

Roads significantly modify landscapes and ecological processes; at the same time, roads facilitate public access and accomplishment of many land stewardship objectives. When planning and implementing restoration activities, managers need to: (a) consider the role roads play in facilitating public access and resource management; and (b) address the impacts of existing roads and road-related effects.

The intent of ICBEMP road restoration direction is to reduce road-related adverse effects through a variety of techniques including obliteration, closures, and road improvements. The direction acknowledges that road risk and road effects are not determined solely by road density but vary substantially depending on factors such as geology, landform, climate, slope position, road condition, and road design. A science-based analytical tool (roads analysis) has been developed to help managers distinguish variability. Roads analysis also can be used to systematically and objectively evaluate road networks for restoration of road-related adverse effects. ICBEMP road restoration direction intends that science-based roads analysis and Subbasin Review be used to pro-vide information and context needed to effectively and efficiently reduce road-related adverse effects.

The overarching intent for roads management within the project area is to progress, in a staged approach, toward a smaller transportation system that can be effectively and efficiently maintained into the future with minimal environmental impact. Restoration should focus primarily on places where reduction of adverse effects and benefits to resources can be maximized—for example, along valley bottoms and main river corridors and in areas where terrestrial, riparian, and aquatic species are negatively affected by human disturbance and direct habitat degradation associated with roads. Generally, most issues surrounding road condition, risk, and management opportunity for restoration are more substantial on forested lands than on rangelands.

R-O12. Objective. Restore terrestrial, riparian, and aquatic habitats where adverse effects or pending risks to these habitats from roads can be quickly reduced and benefits to these species can be maximized.

R-S2. Standard. A science-based roads analysis process shall be used at multiple scales, as appropriate, to systematically and hierarchically evaluate existing road system needs and to establish priorities for road restoration activities.

Rationale: The roads analysis process is intended to identify a balance between (a) the retention of a safe, efficient road system to meet public demands, land stewardship, and tribal needs; and (b) the identification of those roads no longer needed and reduction of adverse effects and potential adverse effects on clean water, aquatic/riparian and terrestrial species habitats, native vegetation, and other natural resources. The intent is that the roads analysis process will be a component of Subbasin Review, EAWS, or other processes, as appropriate, and will support Forest Service or BLM land use plan revision, Access and Travel Management Plans and other transportation plans, water quality restoration plans, and site-specific activity planning.

R-O13. Objective. Progressively reduce road-related adverse effects on watershed integrity, soil productivity, and aquatic/riparian and terrestrial species and their habitats in a staged, annual approach, throughout the life of this plan (10–15 years). Priorities shall be established in part by information and recommendations from Subbasin Review and roads analysis.

Rationale: Road access is needed for resource management, meeting tribal needs, and public use. Tribes, property owners with lands surrounded by federal lands, and others have legal rights to road access to and through agency-administered lands. However, the *Assessment of Ecosystem Components* (Quigley and Arbelbide 1997) identified roads as a major impact on a multitude of physical and biological processes. For example: roads provide a major pathway for the spread of noxious weeds; roadways are prone to erosion and can cause increased sedimentation, adversely affecting hydrologic or sediment regimes and aquatic habitat; road access increases human–wildlife conflicts; and roads fragment terrestrial habitat. In recognizing adverse effects of road systems, there is a need to intentionally and progressively restore some areas through road management practices that reduce adverse effects.

R-S3. Standard. Information to support finer scale restoration-related roads analysis shall be a component of Subbasin Review. Restoration-related roads analysis shall be incorporated into or conducted concurrently with planned EAWS and/or site-specific NEPA analysis.

Rationale: Hierarchical roads analysis will help determine road-related effects and risks and identify beneficial uses and values. Roads analysis at various scales will provide recommendations on locations and techniques to support road restoration activities.

R-G11. Guideline. Consider using the following techniques to reduce adverse effects on aquatic/riparian and terrestrial species and their habitats as feasible:

1. Reconstructing road and drainage features that: do not meet design criteria or operation and maintenance standards; have been shown to be less effective for controlling sediment delivery; prevent attainment of terrestrial, aquatic, or riparian objectives; or do not protect watersheds from increased sedimentation and peak flows.
2. Prioritizing reconstruction based on current and potential damage to terrestrial, aquatic, or riparian resources; ecological value of the resources affected; and feasibility of options such as helicopter logging and road relocation out of riparian conservation areas.
3. Closing and stabilizing or obliterating and stabilizing roads not needed for future management activities. These actions should be prioritized based on current and potential damage to terrestrial, aquatic, and riparian resources and ecological value of the resources affected.

R-S4. Standard. Information from the roads analysis shall be used to reduce road-related adverse effects over the next 10 years. Quality and quantity road indicators and road-related use shall be used to assess the adverse effects on aquatic/riparian and terrestrial species and their habitats. Road quality will be measured by progress toward the road system determined to meet future transportation needs. The primary indicator for road quantity will be Forest Service/BLM-classified roadway miles per square mile measured at the subbasin scale. The primary indicators for road-related use are amount, type, and season of use.

Rationale: The intent of this standard is that restoration activities will be prioritized based on risks and budgets; so that the most significant effects can be reduced first. The intent is not that all road-related effects should be reduced, realizing there are benefits and trade-offs associated with roads.

R-G12. Guideline. Consider including the following techniques when planning and implementing activities to reduce road-related adverse effects and/or accomplish road restoration: obliteration; permanent closures; seasonal closure; road improvements (upgrade culverts, grade, surfacing, design changes); relocation of roads or road segments; and noxious weed control and management.

R-S5. Standard. Where existing structures pose a substantial risk to riparian conditions, design new or improve existing culverts, bridges, and other stream crossings to accommodate a 100-year flood, including associated bedload and debris. Priority for upgrading shall be based on risks and the ecological value of the resources affected as determined from roads analysis. Construct and maintain crossings to prevent diversion of streamflow out of the channel.

Rationale: Structures posing a *substantial risk* are defined as those that do not meet design and operation maintenance criteria, or that have been shown to be less effective for controlling erosion, or that prevent attainment of aquatic, and riparian objectives.

Terrestrial Source Habitat Restoration

Description and Management Intent

> ***Increasing the geographic extent and connectivity of source habitats that have declined significantly from the historical to the current period will require reduction in geographic extent and connectivity of other source habitats that have expanded, such as mid seral multi-story forests.***

The management direction to repattern terrestrial habitats focuses on the vegetation cover types and structural stages that have declined substantially in geographic extent from the historical to current period within most RAC/PAC areas where they existed historically). Examples of such terrestrial habitats are interior ponderosa pine—old forest, single and multi-story, and big sagebrush—open low-medium shrub. The intent of the management direction is to increase the geographic extent and connectivity of these habitats to aid the long-term survival of species dependent on them. Increasing the geographic extent and connectivity of these source habitats will require reduction in geographic extent and connectivity of other source habitats, such as mid seral multi-story forests, that have expanded in geographic extent from the historical to current period. Management actions to repattern terrestrial habitats by increasing the geographic extent of source habitats that have declined substantially should, over time, provide a framework for well-connected networks of source habitat for terrestrial species.

This direction is intended to be followed wherever restoration occurs. Whenever possible, restoration management should be applied outside the source habitat(s) in T watersheds. This is intended to achieve the long-term management objective to facilitate persistence of the source habitats and augment their extent and connectivity. Unless otherwise specified, source habitat discussions in this section refer to all 12 Terrestrial Families as identified in Wisdom et al. (in press). See the Base Level Terrestrial Source Habitats Description and Management Intent for information on source habitats and the 12 Terrestrial Families.

General Terrestrial Habitat Restoration

R-O14. Objective. Restore terrestrial source habitats to provide for species needs. Increase the geographic extent of vegetation cover type–structural stages that have declined substantially from the historical to the current period within most RAC/PAC areas in the project area, and repattern the vegetation patches so they are consistent with disturbance regimes and with the landform, climate, and biological and physical characteristics of the ecosystem.

Rationale: Changes have taken place in vegetation composition and structure, which have resulted in a scarcity of some habitats while others are over-represented. Habitats often are established where they are not resilient to disturbance or sustainable in the long term. By repatterning terrestrial habitats to be more consistent with the disturbance regime and other ecosystem characteristics, the habitats should be more resilient and sustainable. At the same time, repatterning will provide the habitats terrestrial species are lacking.

R-G13. Guideline. Consider using prescribed fire for reducing woody species such as ponderosa pine, juniper, Douglas-fir, and mountain big sagebrush, on sites where they are displacing the native understory vegetation and where perennial grasses are still present in adequate amounts to permit fire.

Old Forest/Rangeland Habitat Restoration Priorities

Broad-scale old forest/ rangeland habitat restoration priorities (Map 3-5) and a subsidiary map used in its development (Proposed Terrestrial Family Habitat Restoration Emphasis [Map 2-11a, in Chapter 2]; developed from maps in Wisdom et al. [in press]), were used to develop the broad-scale high restoration priority subbasins (Maps 3-8 and 3-9) and to provide broad-scale context for finer scale terrestrial habitat restoration priorities and approaches. Some finer

scale terrestrial habitat restoration priorities (for example, the restoration direction and management intent for T watersheds) are provided in this EIS because of the urgency to secure terrestrial source habitats in the short and long terms from threats to its geographic extent and condition. During Subbasin Review, the broad-scale old forest/rangeland habitat restoration priorities (see Map 3-5) and T watershed restoration priorities (Map 3-10) can be integrated to develop a mid-scale strategic approach to restore terrestrial source habitats. This is intended to help achieve a well-connected network of secure and productive habitats, which should ensure the long-term survival of populations or species.

R-O15. Objective. During Subbasin Review, use broad-scale old forest/rangeland habitat restoration priorities (Map 3-5) combined with the T watersheds (see Map 3-10) to provide a broad-scale context when developing local long-term terrestrial habitat restoration priorities and approaches.

***Rationale*:** Integrating the old forest/rangeland habitat restoration priorities (see Map 3-5 and Appendix 15 [Restoration Strategy]) with the T watersheds would provide broad-scale context concerning the relative importance of terrestrial habitat restoration within one subbasin compared with its importance in the project area as a whole. While using Map 3-5, the Proposed Terrestrial Family Habitat Restoration Emphasis map (Map 2-11a, used to develop Map 3-5) should also be considered because it gives a subbasin-scale insight into the Terrestrial Families and their source habitats that have decreased the most (in geographic extent) on BLM- and Forest Service-administered lands.

Forest Composition and Structure

R-O16. Objective. Increase the geographic extent of the forest cover types and/or structural stages listed in Table 3-1, where they are consistent with the landform, climate, and biological and physical characteristics of the ecosytem and where they have declined substantially in geographic extent from the historical to the current period within most RAC/PAC areas in the project area. In forestlands, the highest priority is in watersheds dominated by the dry forest potential vegetation group in areas with high fuel levels, high potential for crown fire, and high risk from insects and disease. Focus next on watersheds dominated by the moist forest PVG.

***Rationale*:** Fire suppression and timber management practices have caused substantial changes in the geographic extent and connectivity of some forest cover types. The geographic extent of forest cover types in Table 3-1 has declined substantially since the historical period as a result of management actions. The intent of this objective is to increase the geographic extent and connectivity of these cover types through mostly active restoration activities. These activities include, but are not limited to, harvest, thinning, prescribed and managed wildland fire, and planting. The greatest departure (difference) from historical conditions has taken place in dry forest PVGs. Priority should be given to restoring whole hydrologic units if resources are available and if the land base provides the opportunity.

Aspen: Aspen is a declining cover type that is important to many wildlife species and is intended to be restored where it existed on the landscape. Vigorous aspen stands readily regenerate after disturbance events. In the absence of disturbance, aspen trees age and are replaced by other cover types, such as shade-tolerant conifers. Aspens that have aged to a stage of decadence do not regenerate well. Stands can be regenerated by fire and/or overstory removal if they have adequate vigor. Aspens may be planted where stands are too decadent to regenerate or where the clone has disappeared from the site. The key is to keep the stand recycling through application of periodic disturbances. It is intended that administrative units continue to produce enough aspen stands in the stand-initiation stage to ensure adequate future levels of a mix of age classes on the landscape.

Single story and multi-story old forest (low elevation): Of the cover type–structural stages used by wildlife species associated with low elevation old forest, the single story ponderosa pine has had the greatest net decline since historical times. Others that have declined substantially in geographic extent from the historical to the current period are the multi-story western larch, interior ponderosa pine, and cottonwood-willow. The terrestrial strategy in part manages long-term risk; for example, increasing the geographic extent of these late seral cover type–structural stages to levels closer to historical. The components of old forests that are most important to restore are the plentiful number and large size of snags and the elements important for connectivity of terrestrial species populations and for soil productivity. From a basin-wide perspective, the loss of large ponderosa pine trees is particularly significant. Other important old forest elements are stand-initiation patches and clumps of snags that are in decline.

Single story and multi-story old forest (mid-upper elevation): Of the cover type–structural stages used by species associated with mid-upper elevation old forest, single-story ponderosa pine, western larch, and whitebark pine have declined in geographic extent the

Table 3-1. Forest Source Habitats.

Increase Geographic Extent and Connectivity of These Cover Types and/or Structural Stages	Structure	Broad-scale Priority Areas (ERUs)	Broad-scale Priority Areas (RAC/PACs)
Source Habitat for Terrestrial Families 1 and 2: Low elevation, single story and multi-story old forest and mature forest with old-forest characteristics.			
Interior ponderosa pine	Single story	Northern Cascades Southern Cascades Upper Klamath Northern Great Basin Columbia Plateau Blue Mountains Northern Glaciated Mnts Lower Clark Fork Upper Clark Fork Owyhee Uplands Central Idaho Mountains	Yakima PAC Eastern Washington-Cascades PAC Eastern Washington RAC Deschutes PAC Southeast Oregon RAC Klamath PAC Upper Columbia-Salmon Clearwater RAC John Day RAC Butte RAC Upper Snake RAC Lower Snake RAC
Interior ponderosa pine	Multi-story	Northern Cascades Southern Cascades Northern Glaciated Mnts Lower Clark Fork Upper Clark Fork Central Idaho Mountains	Yakima PAC Eastern Washington-Cascades PAC Eastern Washington RAC Deschutes PAC Butte RAC Upper Columbia-Salmon Clearwater RAC Lower Snake RAC
Western larch	Multi-story	Northern Cascades Southern Cascades Blue Mountains Northern Glaciated Mnts Lower Clark Fork Upper Clark Fork	Yakima PAC Eastern Washington-Cascades PAC Eastern Washington RAC Descutes PAC John Day RAC Butte RAC Upper Columbia-Salmon Clearwater RAC
Aspen and cottonwood-willow cover type–structural stages	Multi-story	All ERUs	All RACs and PACs
Source Habitat for Terrestrial Family 2: Mid to upper elevation, single story and multi-story old forest and mature forest with old-forest characteristics			
Interior ponderosa pine	Single story	Northern Cascades Southern Cascades Upper Klamath Northern Great Basin Columbia Plateau Blue Mountains Northern Glaciated Mnts Lower Clark Fork Upper Clark Fork Owyhee Uplands Central Idaho Mountains	Yakima PAC Eastern Washington-Cascades PAC Eastern Washington RAC Deschutes PAC Southeast Oregon RAC Klamath PAC Upper Columbia-Salmon Clearwater RAC John Day RAC Butte RAC Upper Snake RAC Lower Snake RAC
Whitebark pine	Single story	Northern Cascades Southern Cascades	Yakima PAC Eastern Washington-Cascades PAC

Table 3-1. Forest Source Habitats. (continued)

Increase Geographic Extent and Connectivity of These Cover Types and/or Structural Stages	Structure	Broad-scale Priority Areas (ERUs)	Broad-scale Priority Areas (RAC/PACs)
		Upper Klamath Northern Great Basin Blue Mountains Northern Glaciated Mnts Lower Clark Fork Upper Clark Fork Owyhee Uplands Snake Headwaters Central Idaho Mountains	Eastern Washington RAC Deschutes PAC Southeast Oregon RAC Klamath PAC John Day RAC Upper Columbia-Salmon Clearwater RAC Butte RAC Upper Snake RAC Lower Snake RAC
Interior ponderosa pine	Multi-story	Northern Cascades Southern Cascades Northern Glaciated Mnts Lower Clark Fork Upper Clark Fork Central Idaho Mountains	Yakima PAC Eastern Washington-Cascades PAC Eastern Washington RAC Deschutes PAC Butte RAC Upper Columbia-Salmon Clearwater RAC Lower Snake RAC
Western larch	Mult-story	Northern Cascades Southern Cascades Blue Mountains Northern Glaciated Mnts Lower Clark Fork Upper Clark Fork	Yakima PAC Eastern Washington-Cascades PAC Eastern Washington RAC Deschutes PAC John Day RAC Butte RAC Upper Columbia-Salmon Clearwater RAC
Aspen and Cottonwood-willow cover type-structural stages	Multi-story	All ERUs	All RAC/PACs
Western White pine	Stand-initiation	Northern Glaciated Mtns Lower Clark Fork	Butte RAC Upper Columbia-Salmon Clearwater RAC Easterm Washington RAC
Source Habitat for Terrestrial Families 2 and 4:			
Interior ponderosa pine	Stand-initiation	Northern Cascades Southern Cascades Northern Great Basin Columbia Plateau Blue Mountains Northern Glaciated Mts Lower Clark Fork Upper Clark Fork Owyhee Uplands Central Idaho Mountains	Yakima PAC Eastern Washington-Cascades PAC Eastern Washington RAC Deschutes PAC Southeast Oregon RAC Klamath PAC Upper Columbia-Salmon Clearwater RAC John Day RAC Butte RAC Upper Snake RAC Lower Snake RAC
Douglas-fir	Stand-initiation	Southern Cascades Upper Klamath Lower Clark Fork	Yakima PAC Deschutes PAC Southeast Oregon RAC

Table 3-1. Forest Source Habitats. (continued)

Increase Geographic Extent and Connectivity of These Cover Types and/or Structural Stages	Structure	Broad-scale Priority Areas (ERUs)	Broad-scale Priority Areas (RAC/PACs)
		Upper Clark Fork Central Idaho Mountains	Klamah PAC Butte RAC Upper Columbia-Salmon Clearwater RAC Lower Snake RAC
Western larch	Stand-initiation	Northern Cascades Northern Glaciated Mtns Lower Clark Fork Upper Clark Fork	Yakima PAC Eastern Washington-Cascades PAC Eastern Washington RAC Butte RAC Upper Columbia-Salmon Clearwater RAC
Lodgepole pine	Stand-initiation	Northern Great Basin Columbia Plateau Upper Klamath Northern Great Basin Northern Glaciated Mtns Lower Clark Fork Upper Clark Fork	Southeast Oregon RAC Eastern Washington RAC Deschutes PAC Yakima PAC Upper Columbia-Salmon Clearwater RAC John Day RAC Klamath PAC Butte RAC Upper Columbia-Salmon Clearwater RAC
Source Habitat for Terrestrial Families 1, 2, and 4:			
Aspen	Old forest; multi-story, unmanaged young forest; managed young forest; understory reinitiation; stem exclusion closed canopy; stand initiation	All ERUs	All RACs and PACs

Source: Hann, Jones, Karl, et al. 1997; Wisdom et al. in press.

most since historical times. Multi-story western larch, interior ponderosa, western white pine, and cottonwood–willow are also in decline (in geographic extent). Increasing the geographic extent of these late seral cover type–structural stages to levels closer to historical is one way to manage long-term risk of disturbance to terrestrial species and habitats. The most important components for Terrestrial Family 2 are old forest and snags, especially large snags. Loss of riparian woodlands, declines in riparian condition, and reductions in downed logs and coarse woody debris also have reduced terrestrial species populations. Other contributing factors include loss of large trees, aspen, and cottonwood–willow woodlands; and reduced longevity of early seral forest.

Stand-initiation: The stand-initiation structural stage is very important as habitat for a number of terrestrial species. Across the basin, stand-initiation forest types have declined since historical times. The western white pine stand-initiation cover type–structural stage has declined significantly, especially in the Lower Clark Fork ERU (see Map 2-1, in Chapter 2). The geographic extent of other cover types in the stand-

initiation structural stage did not consistently increase or decrease across any of the ERUs (this information was not assessed for RAC/PAC areas). Stand-initiation is often the shortest successional stage because of efficient regeneration efforts and rapid initial seedling growth. Continual recruitment of the stand-initiation stage is required to provide for the wildlife species that need this stage. It is desirable to increase the area of stand-initiation forest in subbasins where geographic extent of stand-initiation stage is less than desired. In other subbasins, disturbances may be managed so new openings in forest stands balance the amount of stand-initiation stage that matures into mid seral forest. Leaving large trees and snags in these openings, when possible, makes them more valuable to wildlife species that depend on a stand-initiation stage.

R-G14. Guideline. On sites dominated by ponderosa pine, Douglas-fir, and/or western larch, consider removing ladder fuels and reducing stand density to a level at which a fire cannot spread in the tree canopy consistent with landform, climate, and biological and physical characteristics of the ecosytem.

R-G15. Guideline. On sites where aspen is currently being replaced by conifers or where stem exclusion/ closed canopy stages are declining in health, consider restoring seral stages dominated by aspen.

R-G16. Guideline. Consider restoring late seral structure in large blocks of habitat that are representative of the likely pattern that occurred with historical disturbance events.

R-O17. Objective. Increase the geographic extent of *interior ponderosa pine* cover type in the stem exclusion closed canopy structural stage in the following RAC/ PAC areas: Yakima, Eastern Washington-Cascades, Eastern Washington, Deschutes, Southeast Oregon, Klamath, Upper Columbia/Salmon-Clearwater, John Day, Butte, Upper Snake, and Lower Snake where it is consistent with the landform, climate, and biological and physical characteristics of the ecosystem. Do this by converting from shade-tolerant cover types where they have taken over interior ponderosa pine stands and decreasing the geographic extent of managed young multi-story interior ponderosa pine in all RAC/PAC areas except the Lower Snake River, Upper Snake, and Klamath RACs.

***Rationale*:** The ponderosa pine cover type has declined throughout the interior Columbia Basin (Hann, Jones, Karl, et al. 1997, Wisdom et al. in press). Some of the largest declines have taken place in the stem exclusion closed canopy structural stage, except in the Lower Snake and Upper Snake RAC areas where ponderosa pine is a small component, and the Butte RAC area where the stem exclusion closed canopy structural stage has expanded since historical times. On the other hand, the managed young multi-story ponderosa pine forests, which did not exist until modern times, have become prevalent in all RAC/ PAC areas except the Lower Snake River, Upper Snake, and Klamath RACs. Activities that change the managed young multi-story ponderosa pine forests to characteristics of stem exclusion closed canopy are appropriate where it is consistent with the landform, climate, and biological and physical characteristics of the ecosystem. Where these ponderosa pine forests have been converted to shade-tolerant species, it may be necessary to bring ponderosa pine back to the site through a stand-initiation stage.

The ponderosa pine stem exclusion closed canopy structural stage can be maintained through thinning and prescribed burning. However, it should not be maintained at any cost. The intent of this objective is that as this structural stage matures, it will develop old-forest characteristics and the structural stage will change to old forest single-story with lesser old forest multi-story.

This cover type-structural stage is used by Terrestrial Family 6 (forests, woodlands, and montane shrubs) and Terrestrial Family 7 (forest, woodlands, and sagebrush). It is one of two cover type-structural stages used by the seven Terrestrial Families which have shown a decline at the broad scale.

R-O18. Objective. In the moist forests of the Butte, Upper Columbia-Salmon Clearwater and Eastern Washington RAC/PACs increase the geographic extent of *western white pine.* Expand this cover type in the old forest multi-story, stem exclusion closed canopy, understory reinitiation, and stand-initiation structural stages (source habitat for Terrestrial Family 2). Continue to plant blister-rust-resistant stock and reduce competition to increase the abundance, genetic diversity, and distribution of these species.

Rationale: The western white pine cover type has declined 95 percent from historical to current periods because of timber harvest, wildfire suppression, and white pine blister rust. In the Butte, Upper Columbia/Salmon-Clearwater and Eastern Washington RACs, loss of western white pine has had a tremendous impact on the ecology of forest ecosystems, disturbance regimes, and wildlife species that use those habitats (Hann, Jones, Karl, et al. 1997; Wisdom et al. in press). These cover type–structural stages are used by Terrestrial Family 2 (old forest all elevation), Terrestrial Family 3 (forest mosaic), Terrestrial Family 5 (forest and rangeland mosaic), Terrestrial Family 6 (forests, woodlands, and montane shrubs), Terrestrial Family 7 (forest, woodlands, and sagebrush), and

Terrestrial Family 8 (rangeland and early and late seral forest).

R-G17. Guideline. To increase the overall abundance, diversity, and distribution of western white pine, or to restore its dominance where fire regimes would have encouraged it, consider a variety of techniques such as:

- Selecting and testing new candidate rust-resistant trees, and judiciously using lower levels of rust-resistance trees;
- Reducing mortality of infected pine through intermediate treatments such as pruning and canker excision;
- Minimizing selection pressure on fungus by conservative use of highly rust-resistant pine stock;
- Monitoring for new races of rust;
- Reducing competition and promoting more open stands which are less conducive to rust and spread; and
- Protecting existing stands.

R-O19. Objective. In cold forests, increase the geographic extent of *whitebark pine* where it is adapted (source habitat for Terrestrial Family 2). Plant blister rust resistant stock where available and reduce competition to increase the abundance, genetic diversity, and distribution of these species.

Rationale: Whitebark pine is an important component of some cold forest ecosystems in the project area and is a vital food source for several wildlife species. Whitebark pine has declined substantially from historical times because of wildfire suppression and white pine blister rust (Hann, Jones, Karl, et al. 1997; Wisdom et al. in press). This decline has had a negative impact on cold forest ecosystems, disturbance regimes, and the wildlife species that use cold forest habitat.

R-G18. Guideline. Consider the following techniques to reestablish whitebark pine and subalpine larch to desired ranges of abundance and distribution:

- Collecting seed from blister rust-resistant stock, and either sowing seeds or planting seedings;
- Making grafts of resistant phenotypes and plants;
- Cross-breeding several blister rust-resistant trees;
- Artificially inoculating seedlings from rust-resistant or cross-bred stock;
- Increasing effectiveness of pruning and excising cankers in areas with moderate hazard;
- Monitoring for new races of blister rust;
- Reducing competition;
- Protecting existing stands.

R-O20. Objective. In *dry forest* PVGs, create open stands where the natural disturbance regime maintained open forests of Douglas-fir, ponderosa pine, western larch, or juniper, which will improve source habitat for Terrestrial Families 1, 2, and 4.

***Rationale*:** Open stands should be more resilient to wildfire, insects, and disease and should help to restore hydrologic systems. Restoration actions may include prescribed and managed wildland fire, thinning, and harvest where these forests have dense, closed canopy conditions.

Rangelands Composition and Structure

R-O21. Objective. Increase the geographic extent and connectivity of rangeland cover types and structural stages (terrestrial source habitats) that have declined substantially in geographic extent from the historical to the current period (see column 1 in Table 3-2) on sites where they can be sustained by the combination of landform, climate, and biological and physical characteristics. To achieve this, focus restoration management actions on decreasing the geographic extent of vegetation cover types and structural stages listed in column 2 of Table 3-2. These vegetation types have increased in geographic extent since the historical period and have contributed to declines in the source habitats that have decreased substantially since the historical period. Broad-scale priority RAC/PAC areas are identified in Table 3-2 for these restoration management actions.

***Rationale*:** The Landscape Dynamics chapter (Hann, Jones, Karl, et al. 1997) of the *Assessment of Ecosystem Components* and Wisdom et al. (in press) provided information used to identify cover types and structural stages of terrestrial source habitats that declined substantially in geographic extent from the historical to the current period in the project area. Hann, Jones, Karl et al. (1997) also identified the most important changes from one cover type to another cover type that contributed to these declines. The decline in geographic extent of these cover types and structural stages was caused, in part, by increases in geographic extent of other cover types and structural stages. These changes can be caused by past management actions and land uses, such as fire suppression, excessive livestock grazing pressure, introduction

and spread of exotic plants, and urban and agricultural development. Such actions and land uses have led to the decline, and in some cases listing, of terrestrial species by reducing the available habitat necessary for maintaining their life cycles. Priority should be given to restoring whole hydrologic units, if resources are available and if the land base provides the opportunity.

Actions necessary to reduce the geographic extent and connectivity of cover types and structural stages listed in column 2 of Table 3-2 include but are not limited to: prescribed and wildland fire management; mechanical treatments (roto-mowing, thinning, harvest); weed control (chemical, mechanical, biological, and cultural); rehabilitation seedings. Follow-up management includes: livestock grazing modifications (season, timing, duration, frequency, intensity), fire management (reintroduce fire to some areas, suppress fire in other areas), and recreation management (all-terrain and other vehicles, people, and their recreation animals) to reduce the spread of weeds and disturbance to ecosystems.

R-G19. Guideline. Consider identification and delineation for management of juniper: (1) where it is encroaching but where native understory decline has not yet resulted; (2) where it has encroached and increased in density to a point where native understory has declined; and (3) where its density has increased to a point where all native understory vegetation has been displaced.

R-G20. Guideline. To reduce juniper seedlings and trees, consider implementing prescribed fire on sites where existing fuel levels are adequate to create flame lengths sufficient to kill juniper. Examples include: areas with more than one large juniper tree per acre capable of producing seed; or in dry shrub, dry grass, or cool shrub plant communities with juniper seedlings in the understory.

R-G21. Guideline. On sites where juniper density has increased to the point where understory native vegetation is declining or nearly all understory vegetation has been lost, consider a harvest (cutting or chaining) strategy that leaves slash on site. Consider saving large older trees.

Rationale: This should improve surface soil conditions and permit easier establishment and recovery of native or desired exotic understory vegetation, and to prevent excessive nutrient removal from these sites.

R-G22. Guideline. On sites where juniper is not dense enough to reduce understory vegetation, consider enhancing plant and animal diversity by producing a western juniper-shrub-grassland type mosaic. Consider management that promotes western juniper stands characterized by a full complement of understory vascular and nonvascular vegetation.

R-O22. Objective. Increase the prevalence of Wyoming sagebrush in those seeded areas (for example, crested wheatgrass seedings) that are lacking in structure and are large enough to influence or decrease the connectivity of sagebrush within a subbasin scale. Achieve this by interseeding big sagebrush into these seedings, preferably during times (weather conditions) that are most conducive to sagebrush seeding establishment. Priority areas for this objective are the Southeastern Oregon RAC, Upper Snake RAC, and Lower Snake RAC (source habitat for Terrestrial Families 11 and 12.)

Rationale: Sagebrush cover types have declined more than any other cover type in the basin. Exotic forbs-annual grass cover types have replaced thousand of acres of the Wyoming big sagebrush cover type. In addition, agricultural and urban development have displaced the big sagebrush cover type (Landscape Dynamics chapter [Hann, Jones, Karl, et al. 1997]). In some cases, past rehabilitation efforts of rangeland areas have produced large areas of crested wheatgrass seedings. Some of these areas are lacking in structure and diversity, causing large disruptions in sagebrush cover type connectivity. One intent of this objective is to restore cover types that resemble structurally the big sagebrush cover type. This will increase patch size of the sagebrush cover types which will improve habitat conditions, provide source habitat for Terrestrial Families 11 and 12 (such as sage grouse, pygmy rabbit, and sage sparrow), and provide forage for livestock and other animals.

It is not the intent of this objective to add sagebrush to every crested wheatgrass seeding in the basin. Some seedings are of such small size that at the mid or broad scale they do not seriously affect connectivity of sagebrush cover types. This objective is focused on the larger seedings where sagebrush is lacking and where connectivity of sagebrush cover types is seriously affected. Deciding which seedings and how much sagebrush is needed should be determined during the subbasin or finer scale review processes.

Sagebrush must be seeded during favorable weather or climatic conditions to be successful. Therefore, multiple seeding attempts, over a period of several years, may be needed for achieving this objective.

Table 3-2. Rangeland Source Habitats.[1]

Increase geographic extent & connectivity of these cover types/structural stages	Decrease geographic extent and connectivity of these cover types/structural stages	In what situations	Broad-scale Priority Areas (RAC/PAC)
Source Habitat for Terrestrial Families 5,8,10,12: Fescue-bunchgrass (open herbland and closed herbland structural stages)	Exotic Forbs-Annual Grass	Where exotic undesirable plants have invaded and established into the fescue-bunchgrass cover type	All RAC/PACs
	Interior Ponderosa Pine Interior Douglas-Fir	Where ponderosa pine, Douglas-fir, and/or other trees associated with the interior ponderosa pine and Interior Douglas-fir cover types have encroached into the fescue-bunchgrass cover type and have increased in density, attributable singly or to the combination of fire suppression and excessive livestock grazing pressure.	Butte RAC
	Interior Ponderosa Pine Mixed-Conifer Woodlands	Where ponderosa pine, lodgepole pine, Douglas-fir, white fir, and/or other coniferous trees associated with the interior ponderosa pine and mixed-conifer woodlands cover types have encroached into the fescue-bunchgrass cover type and have increased in density, attributable singly or to the combination of fire suppression and excessive livestock grazing pressure	Klamath PAC
Source Habitat for Terrestrial Families 3,5,8,10,12: Wheatgrass Bunchgrass (open herbland and closed herbland structural stages)[2]	Exotic Forbs-Annual Grass	Where exotic undesirable plants have invaded and established into the wheatgrass bunchgrass cover type	All RAC/PACs
	Mountain Big Sagebrush Big Sagebrush	Where mountain big sagebrush, big sagebrush, and/or other shrubs associated with the mountain big sagebrush and big sagebrush cover types have encroached into the wheatgrass bunchgrass cover type and have increased in abundance, attributable singly or to the combination of fire suppression and excessive livestock grazing pressure	Lower Snake RAC Upper Snake RAC Upper Columbia-Salmon Clearwater - R4 RAC
Source Habitat for Terrestrial Families 5,7,8,10,11,12: Mountain Big Sagebrush (especially the open low-medium shrub structural stage)	Juniper/Sagebrush[3]	Where juniper (primarily western juniper) have encroached into the mountain big sagebrush cover type and have increased in density, attributable singly or to the combination of fire suppression and excessive livestock grazing pressure[4]	Yakima PAC E. Washington-Cascades PAC E. Washington RAC Southeastern Oregon RAC Klamath PAC Deschutes PAC Upper Columbia-Salmon Clearwater - R4 RAC John Day RAC Upper Snake RAC Lower Snake RAC
	Exotic Forbs-Annual Grass	Where exotic undesirable plants have invaded and established into the mountain big sagebrush cover type	Southeastern Oregon RAC Lower Snake RAC
	Interior Douglas-Fir	Where Douglas-fir and/or other trees associated with the Interior Douglas-fir cover type have encroached into the mountain big sagebrush cover type and have	Upper Snake RAC

		increased in density, attributable singly or to the combination of fire suppression and excessive livestock grazing pressure	
Source Habitat for Terrestrial Families 5,7,8,10,11,12: Low Sage (open low-medium shrub structural stage)	Juniper/Sagebrush	Where juniper (primarily western juniper) have encroached into the low sage cover type and have increased in density, attributable singly or to the combination of fire suppression and excessive livestock grazing pressure[4]	Klamath PAC
Source Habitat for Terrestrial Families 5,7,8,10,11,12: Big Sagebrush (closed herbland, open low-medium shrub, and closed low-medium shrub structural stages)	Exotic Forbs-Annual Grass	Where exotic undesirable plants have invaded and established into the big sagebrush cover type	Yakima PAC E.Washington-Cascades PAC E. Washington RAC Southeastern Oregon RAC Klamath PAC Deschutes PAC Upper Columbia-Salmon Clearwater - R4 RAC John Day RAC Upper Snake RAC Lower Snake RAC
Source Habitat for Terrestrial Families 3,5,7,10,11: Antelope Bitterbrush-Bluebunch Wheatgrass	Exotic Forbs-Annual Grass	Where exotic undesirable plants have invaded and established into the antelope bitterbrush-bluebunch wheatgrass cover type	E. Washington-Cascades PAC Yakima PAC E. Washington RAC John Day RAC Deschutes PAC Southeastern Oregon RAC Lower Snake RAC
Source Habitat for Terrestrial Families 5,7,10,11: Salt Desert Shrub	Exotic Forbs-Annual Grass[5]	Where exotic undesirable plants, especially cheatgrass, have invaded and established into the salt desert shrub cover type	Southeastern Oregon RAC Lower Snake RAC

[1] The rangeland source habitats in this table includes herblands, shrublands, woodlands.

[2] Although seedings of crested wheatgrass and other exotic grasses typically done on rangelands for rehabilitation after wildfire are included in the wheatgrass bunchgrass cover type (Hann, Jones, Karl et al. 1997 and Wisdom et al. in press), the intent of objective R-O21 is to focus on increasing the geographic extent and connectivity of the native bunchgrass species (such as bluebunch wheatgrass, Sandberg bluegrass, and Basin wildrye) within the wheatgrass bunchgrass cover type.

[3] The intent of objective R-O21 is not to reduce the geographic extent and connectivity of "old juniper woodlands" dominated by trees older than 150 years, that would typically be classified as the juniper woodlands cover type. The juniper woodlands cover type, in contrast to the juniper-sagebrush cover type, typically has an old tree component. The juniper woodlands cover type generally represents sites where juniper species are confined to rocky surfaces or ridges, with well-drained, shallow soils that produce relatively little understory herbaceous vegetation and have not burned frequently. The juniper-sagebrush cover type generally represents sites where juniper has expanded its range into herblands and/or shrublands, attributable singly or to the combination of fire suppression, excessive livestock grazing pressure, and climate (Karl and Leonard 1996; Hann, Jones, Karl et al. 1997).

[4] The intent of objective R-O21 is to reduce juniper by burning or appropriate harvest or cutting methods, before the increasing density of juniper begins to reduce the species diversity within the mountain big sagebrush or low sage cover type. This may require taking action before diversity problems are detected through monitoring. The risk is that waiting too long to start juniper control may allow deterioration of the understory to the point that natural regeneration of the original cover type may not be possible. Such delays may end up costing thousands of dollars to control invading exotic plants and to reestablish the native plant community. The focus should be on decreasing geographic extent and connectivity of juniper-sagebrush cover type where active fire suppression and/or livestock grazing have contributed to its expansion, rather than on juniper-sagebrush cover type that has expanded, or is expanding, solely because of climate.

[5] Rehabilitation in the salt desert shrub cover type is difficult to achieve currently. In most cases, the aridity of this cover type precludes reestablishment of desirable native species with current technology. It is the intent of objective R-O21 to concentrate on exotic and noxious plant control, with the hope that natural processes will allow reestablishment of the salt desert shrub plant species, until such time that technological improvements increase the success rate of rehabilitation efforts.

Aquatic/Riparian/Hydrologic Restoration

Description and Management Intent

Aquatic/riparian/hydrologic restoration direction refers to the reestablishment of watershed functions, processes, and structures, including natural diversity. The management intent of the ICBEMP watershed restoration direction is to recognize the variability of natural systems while: (1) securing existing habitats that support the strongest populations of wide-ranging aquatic species and the highest native diversity and integrity (such as in A1 and A2 subwatersheds); (2) extending favorable conditions into adjacent watersheds to create a larger or more contiguous network of suitable and productive habitats; and (3) restoring hydrologic processes to ensure favorable water quality conditions for aquatic, riparian, and municipal uses. Aquatic, riparian, and hydrologic restoration uses passive or active approaches, or a combination of both, to move toward objectives.

An important item to consider in the restoration and expansion of productive aquatic habitats and water quality is the spatial and temporal context of historical and current disturbance regimes. Historically, major disturbance regimes influenced the pattern and productivity of aquatic habitats within the project area. Past land management has changed disturbance regimes, leading to simplified aquatic habitats and declines in water quality in the project area. Geologic and climatic setting and changes in disturbance regimes present both opportunity and risk to land managers attempting to restore aquatic habitats and changed hydrologic processes.

The following restoration direction provides linkages to other restoration strategies that may be contained in: federal, state, and tribal water quality restoration priorities; and state and tribal aquatic species restoration plans (such as the Montana Bull Trout Plan).

Restoration management direction is presented in two subsections: aquatic/riparian restoration objectives, priorities, and issues; and water quality and hydrologic processes restoration. In most instances, there is a link among disrupted hydrologic processes, degraded water quality, and non-productive aquatic habitat. Therefore, the overall intent is to integrate both restoration needs (aquatic/riparian and hydrologic/water quality) to complement achievement of objectives wherever possible.

General Aquatic/Riparian Restoration

The following objectives describe the general broad-scale intent of aquatic/riparian restoration within the project area. Attainment of these objectives will require decades. These objectives cannot be achieved in all areas because of physical (dams) and biological (exotic aquatic species) limitations.

R-O23. Objective. Restore connectivity within and among watersheds and networks of well-distributed high quality habitats that sustain populations of aquatic and riparian-dependent species.

***Rationale*:** Lateral, longitudinal, and drainage network connections include floodplains, wetlands, upslope areas, headwater tributaries, groundwater sources, and streams. Effective network connections result in well-dispersed, high quality habitats that provide chemically and physically unobstructed routes to areas that are critical for fulfilling life history requirements of aquatic and riparian-dependent species through space and time.

R-O24. Objective. Restore instream and riparian habitat of sufficient quality, patch size, and distribution to support healthy populations of native fish and riparian-dependent species.

Rationale: It is critical to restore habitats that have been degraded to maintain riparian or wetland-dependent species. Emphasis should be placed on providing diversity in plant species and structure, such as shrubs and large trees, which occurred in the area historically.

R-S6. Standard. Proposed restoration activities shall be evaluated against measurable indicators to help determine consistency with RCA management objectives. Where there is concern with the proposed activity regarding any of the measurable indicators, NEPA analysis shall disclose how the activities will be modified or mitigated to alleviate the concern, or why the activity is needed to achieve RCA management objectives.

Aquatic/Riparian Restoration Priorities

Broad-scale *aquatic* restoration priorities (see Map 3-3) were used to identify the broad-scale high restoration priority subbasins (see Maps 3-8 and 3-9) and to provide context for *finer scale* restoration priorities and approaches. Some finer scale restoration priorities (such as A2 subwatersheds) have been set because of

the urgency to secure habitats in the short term to support attainment of long-term broad-scale restoration objectives (see General Aquatic/Riparian Restoration Objectives). During Subbasin Review, the broad-scale and A2 subwatershed restoration priorities can be integrated to develop a mid-scale strategic approach to restoring aquatic/riparian resources, extending favorable conditions outward from A1 and A2 subwatersheds into adjacent subwatersheds to create a larger or more contiguous network of connected productive habitats.

R-O25. Objective. Use broad-scale aquatic/riparian restoration priorities and the geographic extent of the A1/A2 network during Subbasin Review to provide a broad-scale context when developing local long-term restoration priorities and approaches.

***Rationale*:** Integrating the broad-scale aquatic/riparian priorities with the geographic extent of the A1/A2 network would provide context concerning the relative importance of aquatic resources within a particular subbasin compared to importance of those resources in the project area. This broad-scale context would help determine (a) the relative value of aquatic/riparian resources and contributions toward meeting broad-scale goals and objectives, and (b) whether aquatic conservation and restoration activities should receive high priority. This process would increase the likelihood of success of aquatic resource conservation and restoration actions.

R-S7. Standard. In relation to the broad-scale aquatic/riparian restoration priorities shown in Map 3-3, the following conceptual process shall be used during Subbasin Review to develop and identify a mid-scale strategic approach to aquatic/riparian restoration:

1. As discussed in R-O26, the first consideration for restoration activities is securing A2 subwatersheds and if needed A1 subwatersheds, or securing areas of high aquatic integrity or diversity if A1 or A2 subwatersheds are not present. In this instance, *securing* can mean either reducing threats within the subwatershed or reducing threats in adjacent subwatersheds that pose risks to the functionality of A2 or A1 subwatersheds.
2. The next logical aquatic/riparian restoration priority to be considered is subwatersheds or watersheds adjacent to A1 and A2 subwatersheds or areas of high aquatic integrity or diversity. These areas should have a high potential to respond biologically and physically to restoration actions and result in expansion of diverse habitats.
3. The next logical sequence for aquatic-riparian restoration would be subwater-sheds or watersheds that support spawning and rearing habitat (depressed levels) for native aquatic species that remain connected to larger portions of the subbasin. These areas would provide future important diverse habitats for native aquatic species.

R-G23. Guideline. Consider designing aquatic/riparian restoration actions to influence temporal and spatial diversity of productive aquatic habitat and key aspects of structure and function, such as channel morphology and hydrologic and sediment regimes; riparian vegetation condition and complexity; stream habitat complexity; and channel structure (that is, wood and bank stability).

R-G24. Guideline. Consider focusing aquatic/riparian restoration where a minimal investment can improve or secure the largest amount of productive habitat and diverse riparian- dependent species communities.

R-G25. Guideline. Consider conducting aquatic/riparian restoration first in areas where investments can provide economic and employment opportunities for local economically specialized and isolated and/or tribal communities.

R-G26. Guideline. When developing restoration strategies during Subbasin Review, consider identifying potential complementary opportunities that could occur over similar time frames and in similar areas and that could contribute toward attainment of multiple resource restoration objectives. For example, the need to restore forest conditions may coincide with the need to reduce adverse road effects on aquatic and riparian resources. Likewise, consider identifying potential conflicting restoration needs, and use available information to recommend approaches to minimize conflict while allowing attainment of restoration objectives. For example, consider alternative approaches to reduce negative impacts, such as increased maintenance or relocation of problematic segments, rather than obliterating or closing a road that has high social value but also causes negative effects on aquatic/riparian resources.

R-G27. Guideline. During the appropriate step-down process (programmatic planning, Subbasin Review, EAWS, or site-specific NEPA analysis), existing information, developed as part of the *Snake River Chinook and Sockeye Salmon; Snake River and Upper Columbia River Steelhead; and Klamath River, Columbia River, and Jarbidge River Bull Trout Biological Opinions* should be considered when developing restoration priorities.

R-O26. Objective. In the short term, the first consideration for aquatic/riparian restoration priorities is securing A2, and as needed, Al subwatersheds from internal or adjacent subwatershed risks. If A1 or A2 subwatersheds are not present, then the first consideration is in areas of high aquatic integrity or diversity. Aquatic/riparian restoration efforts should focus on threatened or non-functioning watershed processes, addressing the causative agents while minimizing risks to functioning processes.

Rationale: A1 and A2 subwatersheds represent areas that support the strongest fish populations and highest native diversity and integrity. These subwatersheds serve as the foundation of a conservation strategy and a starting point for a restoration strategy. Strategically, securing these subwatersheds from internal or adjacent threats to watershed function and structure would enhance the short-term persistence of aquatic species and diversity and is necessary to ensure a source of individuals to colonize available habitats following natural recovery or restoration. The step-down process may reveal that the highest restoration priority may not be within A2 subwatersheds, but rather may be in adjacent subwatersheds whose condition poses a threat or represents a greater opportunity to expand productive aquatic habitats.

Specific Aquatic/Riparian Restoration Issues

R-O27. Objective. Strategically, forest health restoration activities generally should occur in upland settings before treatment occurs in riparian areas. Treatments proposed in RCAs need to be consistent with RCA management objectives and standards.

Rationale: The delineation of ecologically appropriate RCAs and associated objectives and standards are presented in the Base Level, Aquatic/Riparian/Hydrologic Component section. The base level management direction provides for the maintenance or improvement of riparian conditions. Specific restoration treatments in RCAs may be necessary in some instances to restore function and connectivity among streams, floodplains, and riparian areas. For example, in some forested landscapes, thinning and prescribed fire may be necessary to encourage development of large trees. In other instances there may be a need to thin trees that have encroached into riparian zones, to encourage shrub growth. Experience from treatment in upland settings can then be applied to RCAs where the primary emphasis is maintenance and restoration of riparian and aquatic functions. In these instances risks and trade-offs need to be well understood.

R-G28. Guideline. Consider the spatial and temporal role of natural disturbances within uplands and riparian areas in creating and maintaining high quality aquatic habitat. Consider vegetation management practices which restore and are compatible with spatial and temporal disturbance processes and patterns that encourage attainment of aquatic/riparian/hydrologic management objectives.

R-O28. Objective. When identifying restoration opportunities, evaluate the distribution of non-native aquatic species and how restoration efforts may change their distribution.

Rationale: The introduction and widespread expansion of non-native aquatic species have contributed to the decline in native aquatic species. The intent of this objective is to identify restoration efforts that could further change the distribution of non-native aquatic species. For example: removing a culvert that represents a migratory barrier to native fish could allow expansion of non-native species if they are currently present below the barrier.

R-O29. Objective. When proposed restoration actions could affect the distribution of non-native species, provide opportunities to states, tribes, or other federal partners to address non-native aquatic species issues under existing MOUs.

R-G29. Guideline. Consider working with federal, tribal, and state fish management agencies to identify and reduce negative effects on aquatic resources associated with fish stocking, fish harvest, habitat manipulation, and poaching.

R-O30. Objective. Initiate collaboration on and cooperation with other landowners when addressing similar aquatic/riparian restoration issues.

Rationale: Historically, many productive aquatic habitats existed in rivers downstream or adjacent to present BLM- or Forest Service-administered lands. Opportunities may exist to cooperatively address watershed restoration needs with adjacent landown-

ers. The intent is to stimulate cooperative restoration activities, not to extend federal land management direction to adjacent ownerships.

R-G30. Guideline. Consider cooperative aquatic/riparian restoration actions with adjacent landowners, particularly in low-elevation floodplain river systems.

R-G31. Guideline. When developing land acquisition and/or proposals, exchange, and conservation easements, consider the benefits and tradeoffs of attaining aquatic and riparian objectives.

Water Quality and Hydrologic Process Restoration

Episodic climatic, geomorphic, and hydrologic processes determine the supply, storage, and transport of water, sediment, and wood, and they shape many aspects of terrestrial and aquatic habitats. These dynamic processes display patterns (across the landscape and through time) of water, sediment, and wood, as well as channel and valley characteristics throughout entire watershed networks. These patterns are best characterized in terms of frequencies of distributions. Effective restoration of hydrologic processes and water quality over the long term must provide for a full range of natural variabilty in these patterns and characteristics and must also account for their dynamic nature.

In addition, restoration must include in-channel, riparian, and upslope components to achieve sustainable intact watersheds and ecosystems. Restoration and maintenance of hydrologic processes and prevention of pollution are the main steps to ensuring water quality that is at potential and will support beneficial uses of the water. Restoration of riparian vegetation, soils, and soil processes is particularly important for successful restoration of water quality because of the buffering soils provide to streams. In addition to other Forest Service/BLM mandates for good land stewardship, the Clean Water Act also mandates federal land management agencies to restore and protect the quality of public waters under their jurisdictions.

The mid scale (subbasin[s] and/or basin[s]) is needed to describe climatic and landscape processes which determine the types of hydrologic and water quality conditions that exist and can be expected. Mid-scale information can also help determine priorities for further analysis and general recommendations that would result in effective restoration strategies. Subbasins needing water quality restoration have been identified and prioritized on a state-by-state basis as part of Clean Water Action Plan (CWAP) implementation strategies. These strategies vary somewhat by scale, processes, and information, but they achieve an overall initial priority for CWAP restoration funding. In some states, legal decisions mandate restoration of water quality in subbasins according to the respective state's 303(d) lists and Total Maximum Daily Load (TMDL) schedules. The ICBEMP Broad-scale Restoration Strategy (Appendix 15) provides a list of subbasins with restoration needs that incorporate 303(d) listed waterbodies and departure of hydrologic processes from historical regimes (see also Map 3-4).

Additional direction on restoration of hydrologic processes and hydrologically driven disturbance regimes is located in the Landscape Restoration section.

R-O31. Objective. Restore water quality, water quantity, and hydrologic processes necessary to support healthy riparian, aquatic, and wetland ecosystems. These processes should be restored to be within the range of variability representative of the inherent capability of the watershed area, and maintained within that range over time.

Rationale: The processes that determine water quality, water quantity and hydrologic condition are not static but vary within a stream system through space and time. Ranges of conditions are difficult to define because the variation is influenced by many things, including climate, both natural and human-caused disturbances within the watershed, and the natural capability determined by the specific geomorphic characteristics of the stream and surrounding watershed. The intent is to restore these processes to frequencies and distributions that are consistent with natural patterns characteristic of geomorphically similar watershed areas.

R-G32. Guideline. When conducting EAWS, consider using the information to provide context for setting hydrologic restoration priorities. Diagnose causal mechanisms and events of modified hydrologic processes leading to degraded watershed conditions and appraise various restoration techniques.

R-S8. Standard. The 303(d) list, state priorities for TMDL development, and existing water quality restoration plans shall be incorporated into Subbasin Review and into Ecosystem Analysis at the Watershed Scale where EAWS is being accomplished.

Rationale: Subbasin Review will be completed for the ICBEMP within five years of signing of the ROD. States within the ICBEMP are developing TMDLs at a subbasin scale. Much of the area within the ICBEMP

will also have Ecosystem Analysis at the Watershed Scale scheduled or completed during this same timeframe. The intent of this standard is to coordinate and integrate broad-, mid-, and watershed-scale information and timelines with state and EPA information and timelines, at similar scales of analysis, to maximize cost-benefit and efficiency of restoration efforts.

R-S79. Standard. State, county, and tribal water quality restoration priorities shall be considered early in the process of Subbasin Review, Ecosystem Analysis at the Watershed Scale, and/or site-specific NEPA analyses and decisions.

R-O32. Objective. Develop and implement water quality restoration plans for all impaired water bodies on Forest Service- and BLM-administered lands by scheduling and implementing the 303(d) protocol at a scale and with time frames that complement state processes and schedules for total maximum daily load (TMDL) development and implementation.

Rationale: Each state has established schedules for development and implementation of TMDLs for waters that have been listed under Section 303(d) of the Clean Water Act (CWA). Such schedules have been or will be accepted by the courts and/or EPA as satisfying CWA requirements for addressing such listed waters. The Forest Service and BLM will retain maximum decision flexibility by self-determining the extent to which activities on lands under their administration affect such listed waters and by developing specific plans that define how such impacts will be addressed so as to restore such waters. The 303(d) protocol was designed to facilitate accomplishment of this objective. The intent of this objective is to take full advantage of partnerships as Clean Water Action Plan (CWAP) implementation evolves and to accomplish restoration using a collaborative watershed-basin approach.

R-O33. Objective. Use existing Memoranda of Understanding (MOUs) with state water quality agencies to initiate partnerships with other federal, state, county, and tribal organizations, watershed councils, private citizens, and non-federal land owners, to maximize the benefits of existing efforts for water quality protection and restoration. Implement restoration in an integrated manner, including cost sharing wherever possible. Also see objective *B-O41* under Base Level Direction.

Rationale: Other federal and state agencies, tribes, counties, and interested stakeholders within the project area have developed or are in the process of developing water quality restoration plans. Many of these efforts are striving to accomplish similar outcomes. The greatest benefits and returns on investments can be obtained where mutual priorities or opportunities can provide a pool of resources to more effectively implement restoration actions.

R-G33. Guideline. Consider cooperating with state water quality agencies when they monitor, review, and compare existing conditions to State Water Quality Standards.

Rationale: It is during their monitoring, review, and determination that the state water quality agencies identify the status of water quality and the risk to beneficial uses of water.

Social–Economic–Tribal Component: Restoration

Description and Management Intent

The social–economic–tribal restoration component highlights areas where restoration activities have a direct influence on human community economic, social, and cultural needs. This direction is inextricably linked to restoration direction provided in the landscape dynamics, terrestrial, and aquatic/riparian/hydrologic sections. The following direction relates specifically to considerations for designing and implementing restoration activities in ways that promote workforce participation, serve demands for commodity products at various levels, encourage intergovernmental collaboration, and consider tribal needs and interests.

R-O34. Objective. When promoting the economic participation of the local workforce in restoration activities, give highest priority to nearby rural communities or geographic areas that are less economically diverse and more economically associated with outputs of goods and services from Forest Service- and BLM-administered lands. These places are referred to in this EIS as "Areas of Economic Specialization" (see Map 2-33, in Chapter 2). For restoration opportunities to assist isolated and economically specialized communities and tribal communities, see Maps 3-6 and 3-7, and Table 3-3. See also objective B-O58 in the Base Level direction section.

Rationale: The intent of this objective is to help sustain isolated, economically specialized communities while they transition to a less specialized condition. It is not intended to discourage or mask the need for economic diversification or other economic development efforts. The objective stems from the recognition that few economic options are available in these areas, that BLM and Forest Service actions may

Table 3-3. Communities with Tribal Headquarters.

Tribal Community	Tribal Government
Browning, Montana	Blackfeet Tribe
Burns, Oregon	Burns Paiute Tribe
Plummer, Idaho	Coeur d'Alene Tribe
Nespelem, Washington	Colville Tribe
Fort Bidwell, California	Fort Bidwell Indian Community
McDermitt, Nevada	Ft. McDermitt Paiute Shoshone Tribes
Usk, Washington	Kalispel Tribe
Chiloquin, Oregon	Klamath Tribe
Bonners Ferry, Idaho	Kootenai Tribe of Idaho
Lapwai, Idaho	Nez Perce Tribe
Blackfoot, Idaho	Northwest Band of Shoshoni Nation
Burney, California	Pit River Tribe
Fort Jones, California	Quartz Valley Indian Community
Pablo, Montana	Confederated Salish and Kootenai Tribes
Fort Washakie, Wyoming	Shoshone Tribe of Wind River
Fort Hall, Idaho	Shoshone-Bannock Tribes
Owyhee, Nevada	Shoshone-Paiute Tribes
Wellpinit, Washington	Spokane Tribe
Winnemucca, Nevada	Summit Lake Paiute Tribes
Pendleton, Oregon	Umatilla Tribe
Warm Springs, Oregon	Warm Springs Tribes
Toppenish, Washington	Yakama Nation

be able to contribute to community vitality, and that the continued existence and vitality of these areas is in the public interest. Maps 3-8 and 3-9 show 15 and 21 subbasins for Alternative S2 and S3, respectively, that were identified as restoration priorities because they have high risk to aquatic and terrestrial species and habitats from natural disturbance, and good opportunity to reduce those risks through restoration activities, and because they provide employment and economic opportunities for isolated and economically specialized communities. For more information on how Areas of Economic were measured, see the *Economic and Social Conditions of Communities* (ICBEMP 1998) and the Restoration Appendix (Appendix 15).

R-O35. Objective. While designing management activities to meet restoration objectives, make commodity products available for purchase, to the extent possible:

1. to support economic activity important to rural and tribal communities and local governments,
2. to maximize regional market efficiencies, and
3. to achieve restoration objectives in an efficient and cost effective way. See also objective B-O64 in the Base Level management direction section.

Rationale: The commercial use of Forest Service- and BLM-administered land resources can provide social, economic, and cultural benefits to society that are compatible with an ecosystem restoration management emphasis.

R-O36. Objective. Collaborate with affected federally recognized tribes to identify restoration opportunities and possible cooperative restoration approaches or actions. Emphasize restoration activities on Forest Service- and BLM-administered lands in subbasins that are near or contain tribal communities which are less economically diverse and have greater need for economic stimulus (see Table 3-3 for a list of these tribal communities). See the broad-scale tribal restoration priority subbasins, shown in Map 3-7, and objective B-O57(S2) in the Base Level management mirection section.

Rationale: This objective has a strong emphasis on identifying high restoration priority subbasins near isolated and economically specialized communities. Maps 3-8 and 3-9 show 11 and 16 subbasins that were identified as restoration priorities for Alternatives S2 and S3, respectively, because they have high risk to aquatic and terrestrial species and habitats from

natural disturbance, they have good opportunity to reduce those risks through restoration activities, and because they provide employment and economic opportunities in tribal communities (see Table 3-3 for a list of these tribal communities). There is also high likelihood that resources associated with the rights and interests of federally recognized tribes will be available in these areas.

R-S10. Standard. When conducting Subbasin Review, EAWS, or applicable site-specific NEPA analysis, collaborate with affected federally recognized tribes and solicit tribally identified restoration opportunities. When possible, accomplish restoration objectives that also address restoration of resource values of importance to federally recognized tribes.

Rationale: Consultation with the tribes may help identify ways to accomplish restoration objectives and at the same time enhance resource values for species of interest to tribes. For example, a tribe might directly benefit from cooperative restoration of a traditional camas-gathering area. In another case, shrubland restoration might provide an indirect benefit if forbs and shrubs of special interest to tribes could be targeted for inclusion in the seeding mixture. Collaborating with tribes during site-specific NEPA analysis is only required if the proposed action relates to resources of interest to the tribes.

R-S11. Standard. Cooperate with tribal efforts regarding research and restoration of treaty/trust resources (for example, habitat re-establishment of salmon in Columbia River tributaries, mule deer in the Klamath Basin, and antelope in eastern Idaho). During EAWS, Subbasin Review, or site-specific NEPA analysis, specifically consider for protection and restoration treaty resources within tribe's areas of interest or ceded lands.

R-S12. Standard. Congruent with achieving restoration objectives, collaborate with federally recognized tribes to design restorative actions that mitigate possible negative effects on resources of interest to tribes.

Rationale: If the agencies discuss and understand tribal needs, numerous ways exist to accommodate the rights and interests of tribes while still accomplishing resource management objectives. For example, the timing of agency actions can be a significant mechanism for accommodation, because many tribal uses are seasonal in nature.

R-G34. Guideline. Consider historically occupied habitats in traditional use areas for restoration of resources/species of interest to tribes. Implementation guidance for Subbasin Review includes examples/possible questions that may help focus restoration discussions. Consider the list of culturally significant plant species (Appendix 8) as a starting point for collaborative discussion with the tribes, as well as the scientific assessment of big game species as they relate to tribes (Lehmkuhl and Kie 1999).

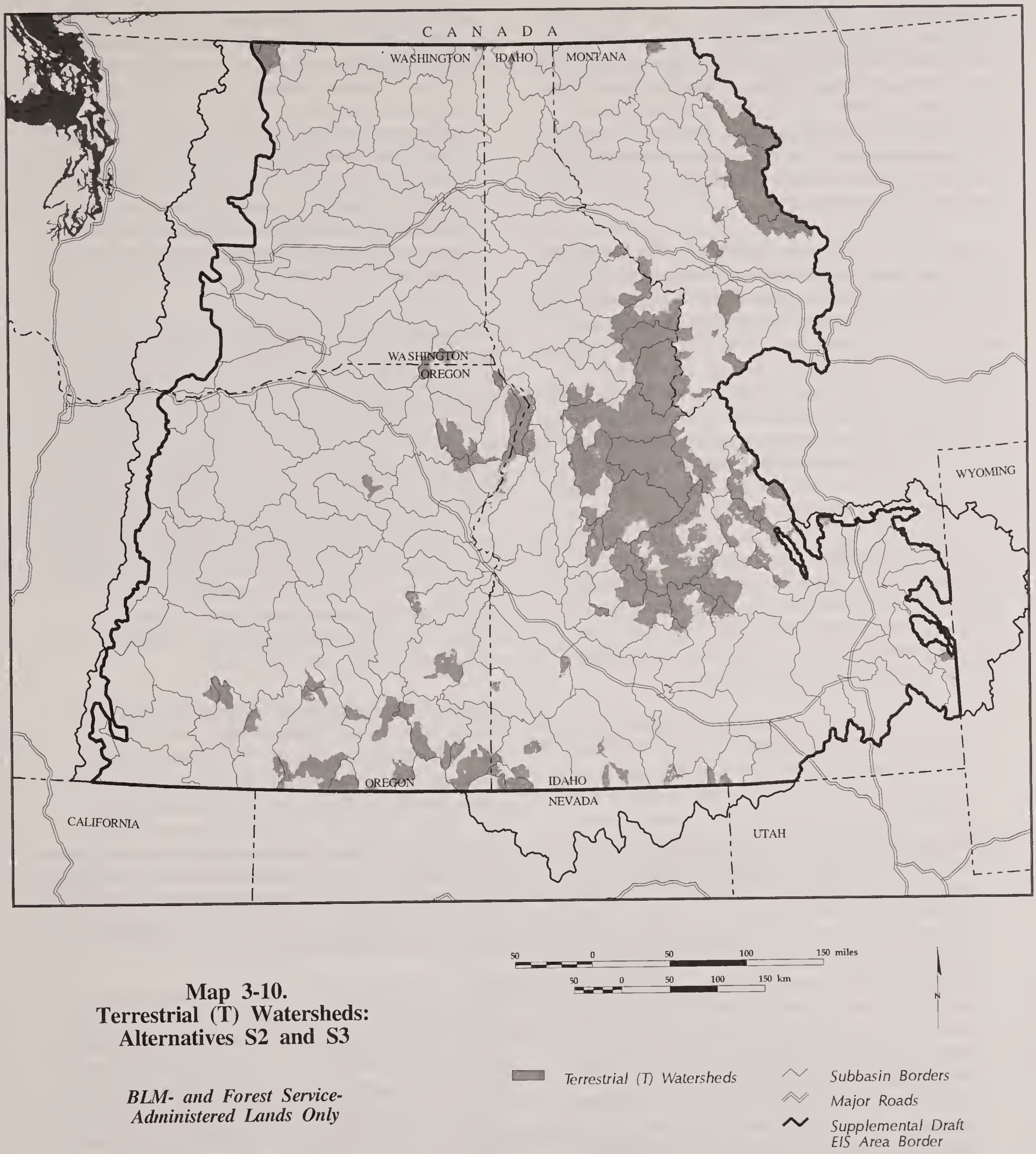
Management Direction — Terrestrial T Watersheds

Description and Management Intent

T watersheds alone do not constitute a network of habitats for terrestrial species. However, they are one piece of the overall strategy to maintain and restore networks of habitat for terrestrial species.

Terrestrial T watersheds (5th-field HUCs), shown on Map 3-10 were identified based on whether they contained source habitat for one or more of 5 "families" of terrestrial species, which are a subset of 12 "families" described in Wisdom et al. (in press). These five families represent groups of species associated with habitats that have *declined substantially in the project area* since historical times. In addition, the pattern of source habitats within these watersheds is most similar to that found historically. The 5 Terrestrial Families and associated species are shown in a sidebar in the Terrestrial Source Habitat Component section of the Base Level Direction. T watersheds alone do not constitute a network of habitats for terrestrial species. However, they are one piece of the overall strategy to maintain and restore networks of habitat for terrestrial species.

T watersheds contain source habitats that are relatively similar in pattern across the landscape compared with historical vegetation patterns (that is, they have *low departure* from historical patterns). To have been selected, T watersheds must have had at least 5 percent BLM- and/or Forest Service-administered lands, although the overwhelming majority of watersheds selected contain more than 80 percent BLM- and/or Forest Service-administered lands. While every acre of source habitat within T watersheds is not necessarily of highest quality, T source habitats can be considered the *most sustainable through time* compared to source habitats in other watersheds.



Map 3-10.
Terrestrial (T) Watersheds: Alternatives S2 and S3

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Source habitats within T watersheds: (1) generally have intact functions and processes (such as plant succession); frequency and severity of disturbance (such as fire, grazing, insects, and disease) that are characteristic for the area; nutrient cycling and energy flow; and (2) generally have certain habitat components (such as large snags, absence of exotic species, and low predicted road densities) that are associated with the low departure from historical patterns.

As used in this EIS, source habitats are the vegetation cover types and structural stages that contribute to stable species populations or population growth in a specified area and time. A species will normally require several source habitats to provide for stable populations or population growth. Each distinct vegetation cover type represents a complex of plant species and groups with similar characteristics. Each cover type can have one to several structural stages (that is, stages of structural development). Source habitats as used here support long-term population persistence (Wisdom et al. in press).

The two-fold (short term and long term) intent of management in T watersheds recognizes that source habitat(s) are not static and that preventing loss of source habitat relates to the whole watershed, not just to a site-specific situation. The intents for management in T watersheds are as follows:

1. In the short term (10 years), T watershed direction has a conservation emphasis. Source habitats that have declined substantially in geographic extent from the historical to the current period in most of the RAC/PAC areas where they existed historically, and those with old-forest characteristics, should be maintained or secured. The short-term intent includes preventing further loss of geographic extent and decline in condition of source habitats that have declined substantially from the historical to the current period. This loss or decline could be caused either by land uses (for example, livestock grazing pressure that exceeds what the cover types can tolerate) or by management actions that collectively or individually would fragment source habitat(s) within and across landscapes and diminish the condition of source habitat(s). Restoration is focused primarily on securing the source habitat, by preventing invasion by noxious weeds, for example.
2. In the long term (more than 10 years), T watershed direction is intended to (a) recruit additional source habitats that have declined substantially in geographic extent from the historical to the current period, to increase their geographic extent and connectivity within the watershed where possible (that is, where they can be sustained by the combination of landform, climate, and biological and physical characteristics); and (b) repattern source habitats on the landscape where and when necessary (see explanation below). The short-term conservation-oriented focus takes precedence over the long-term restoration-oriented focus. Source habitats that have not declined substantially and/or non-source habitats (relative to the five Terrestrial Families) could be manipulated through management actions or natural succession to expand their geographic extent and connectivity and/or to repattern source habitats.

The expectation is that management actions—such as weed control, thinning, prescribed burning, and altered livestock grazing management strategies—will be used as needed to maintain, secure, and restore source habitats. Although the patterns of source habitats in T watersheds are expected to be relatively similar to the historical vegetation patterns, in some cases source habitats will need to be repatterned. For example, restoration of source habitats might require conversion of one source habitat to another (such as from juniper-sagebrush–woodland to mountain big sagebrush–open low-medium shrub). Land uses, such as livestock grazing and timber harvest, are allowed if they are consistent with the objectives and management intent for T watersheds.

Objectives and standards for T watersheds apply only to the source habitat(s) listed in objective T-O1 that occur within the watersheds. These objectives and standards can be superseded only by direction for A1 subwatersheds. If there are other management conflicts, then direction for T watersheds would be followed. Management direction in Restoration and Base Level applies to T watersheds, but direction for source habitats in T watersheds provides the context within which the Restoration and Base Level Management Direction must be implemented.

T-O1. Objective. In the short term, maintain and secure terrestrial source habitats that have declined substantially in geographic extent from the historical to the current period and source habitats that have old-forest characteristics. In the long term, repattern source habitats where and when necessary by focusing on the *entire* set of source habitats (cover types and structural stages) listed within each of the five Terrestrial Families in Tables 3-4 to 3-8 (Terrestrial Families 1, 2, 4, 11, and 12). In the long term, facilitate the persistence and expand the geographic extent and connectivity of source habitats that have declined substantially where they can be sustained by the combination of landform, climate, and biological and physical characteristics. Prior to conducting management actions within the source habitats that have not

declined substantially in geographic extent, evaluate the effects of the action on pertinent species within the five Terrestrial Families to minimize short-term risk to the continued persistence of the species.

Rationale: The intent of this objective is described above in the Description and Management Intent section. Source habitats for the five Terrestrial Families are emphasized because the geographic extent of many of them have declined substantially in the project area between the historical and current period; additional source habitats that have declined substantially are also included for the remaining seven Terrestrial Families (see Table 3-9). A critical premise of the intent of management direction for T watersheds is that short- and long-term conservation of source habitats that have declined substantially and long-term restoration of the pattern of source habitats will help achieve long-term viability of terrestrial species. The T watersheds were identified with the purpose of being used as "anchor points" in the short term, and for the long-term creation of a well-distributed network of secure and productive habitats, which should ensure the long-term survival of populations or species.

T-O2. Objective. Maintain habitats by permitting natural processes, including disturbance events, such as fire, to continue whenever these processes will contribute to long-term sustainability of habitat.

Rationale: Disturbance processes, such as fire, can help maintain watershed qualities. Attempts to exclude these processes, such as with fire suppression, may have long-term detrimental consequences (for example, changes in vegetation and successional dynamics, and direct effects of fire suppression itself). "Wildland fire use for resource benefit" and prescribed fire both require extensive planning and documentation and must meet NEPA and agency requirements.

T-S1. Standard. Management activities and land uses (conducted subject to valid existing rights), individually or collectively, shall be consistent with achievement of Objectives T-O1 and T-O2.

Rationale: Example 1: There might be cases where a prescribed burn in source habitat might be necessary and desirable to maintain and secure it (for example,

Table 3-4. Terrestrial Family 1 — Old Forest, Low Elevation Source Habitat.

Cover Type	Structural Stage
Interior ponderosa pine[1]	Old forest, single and multi-story[1] Managed young multi-story Unmanaged young multi-story
Interior Douglas-fir	Old forest, multi-story
Western larch[1]	Old forest, multi-story[1]
Aspen[1]	Old forest, multi-story[1]
Cottonwood-willow[1]	Old forest, multi-story[1] Managed young multi-story Unmanaged young multi-story
Sierra Nevada mixed-conifer[1]	Old forest, single story Old forest, multi-story[1]
Pacific ponderosa pine[1]	Old forest, single story Old forest, multi-story[1]
Oregon white oak	Woodland[1]

[1] Source habitats that have declined substantially in geographic extent from the historical to the current period.

Table 3-5. Terrestrial Family 2 — Old Forest, Broad Elevation Source Habitat.

Cover Type	Structural Stage
Whitebark pine[1]	Old forest, single story
	Old forest, multi-story[1]
	Unmanaged young multi-story[1]
	Understory reinitiation[1]
Whitebark pine-alpine larch[1]	Understory reinitiation[1]
	Unmanaged young multi-story[1]
	Old forest, multi-story[1]
Engelmann spruce-subalpine fir[1]	Old forest, multi-story[1]
	Unmanaged young multi-story[1]
	Stand initiation
	Understory reinitiation
Interior Douglas-fir	Old forest, single and multi-story
	Stand initiation
	Understory reinitiation
	Unmanaged young multi-story
Western larch[1]	Old forest, single story[1]
	Old forest, multi-story[1]
	Stand initiation[1]
	Understory reinitiation
	Unmanaged young multi-story[1]
Lodgepole pine[1]	Unmanaged young multi-story
	Managed young multi-story
	Stand initiation[1]
	Understory reinitiation
	Old forest, single story[1]
	Old forest, multi-story
Aspen[1]	Old forest, multi-story[1]
	Understory reinitiation[1]
	Stand initiation
	Unmanaged young multi-story
Grand fir-white fir	Old forest, single and multi-story
	Stand initiation
	Understory reinitiation
	Unmanaged young multi-story
Western white pine[1]	Old forest, multi-story[1]
	Old forest, single story
	Understory reinitiation[1]
	Stand initiation[1]
	Unmanaged young multi-story
Interior ponderosa pine[1]	Old forest, single and multi-story[1]
	Stand initiation[1]
	Stem exclusion open canopy
	Understory reinitiation
	Unmanaged young multi-story

Table 3-5. Terrestrial Family 2 — Old Forest, Broad Elevation Source Habitat. (continued)

Cover Type	Structural Stage
Cottonwood-willow[1]	Old forest, multi-story[1] Stand initiation[1] Unmanaged young multi-story
Mixed-conifer woodlands[1]	Woodland[1]
Mountain hemlock[1]	Stand initiation Understory reinitiation Unmanaged young multi-story Old forest, single story Old forest, multi-story[1]
Pacific silver fir-mountain hemlock	Stand initiation Understory reinitiation Unmanaged young multi-story Old forest, multi-story
Western redcedar-western hemlock[1]	Stand initiation Understory reinitiation Unmanaged young multi-story[1] Old forest, single and multi-story
Red fir	Stand initiation Understory reinitiation Unmanaged young multi-story Old forest, multi-story
Sierra Nevada mixed-conifer[1]	Stand initiation Understory reinitiation[1] Unmanaged young multi-story Old forest, single story Old forest, multi-story[1]
Pacific ponderosa pine[1]	Stand initiation Understory reinitiation Unmanaged young multi-story Old forest, single story Old forest, multi-story[1]
Limber pine	Woodland
Shrub or herb-tree regen	Closed herbland Open low-medium shrub Closed low-medium shrub
Chokecherry-serviceberry-rose[1]	Open low-medium shrub Closed low-medium shrub[1] Open tall shrub

[1] Source habitats that have declined substantially in geographic extent from the historical to the current period.

Table 3-6. Terrestrial Family 4 — Early-seral Forest Source Habitat.

Cover Type	Structural Stage
Interior ponderosa pine[1]	Stand initiation[1]
Interior Douglas-fir	Stand initiation
Western larch[1]	Stand initiation[1]
Aspen	Stand initiation
Cottonwood - willow[1]	Stand initiation[1]
Engelmann spruce-subalpine fir	Stand initiation
Lodgepole pine[1]	Stand initiation[1]
Grand fir-white fir	Stand initiation
Chokecherry-serviceberry-rose[1]	Open low-medium shrub Closed low-medium shrub[1] Open tall shrub

[1] Source habitats that have declined substantially in geographic extent from the historical to the current period.

Table 3-7. Terrestrial Family 11 - Sagebrush Source Habitat.

Cover Type	Structural Stage
Mountain big sagebrush[1]	Open low-medium shrub[1] Closed low-medium shrub
Big sagebrush[1]	Closed herbland[1] Open low-medium shrub[1] Closed low-medium shrub[1]
Low sage	Open low-medium shrub Closed low-medium shrub
Salt desert shrub	Open low-medium shrub Closed low-medium shrub
Antelope bitterbrush-bluebunch wheatgrass[1]	Closed low-medium shrub[1]
Juniper woodlands	Woodland
Juniper-sagebrush	Woodland
Mixed-conifer woodlands[1]	Woodland[1]
Herbaceous wetlands	Open herbland Closed herbland
Chokecherry-serviceberry-rose[1]	Open low-medium shrub Closed low-medium shrub[1] Open tall shrub
Mountain mahogany[1]	Open low-medium shrub[1] Closed low-medium shrub

[1] Source habitats that have declined substantially in geographic extent from the historical to the current period.

Table 3-8. Terrestrial Family 12 - Grassland and Open-canopied Sagebrush Source Habitat.

Cover Type	Structural Stage
Mountain big sagebrush[1]	Open low-medium shrub[1]
Big sagebrush[1]	Closed herbland[1] Open low-medium shrub[1]
Low sage	Open low-medium shrub
Fescue-bunchgrass[1]	Open herbland[1] Closed herbland[1]
Wheatgrass bunchgrass[1]	Open herbland[1] Closed herbland[1]
Shrub wetlands[1]	Open low-medium shrub[1] Closed low-medium shrub Closed tall shrub[1] Open herbland Closed herbland
Herbaceous wetlands	Open herbland Closed herbland
Native forb	Open herbland Closed herbland
Chokecherry-serviceberry-rose[1]	Open low-medium shrub Closed low-medium shrub[1] Open tall shrub

[1] Source habitats that have declined substantially in geographic extent from the historical to the current period.

Table 3-9. Terrestrial Families 3, 5, 6, 7, 8, 9, and 10.

Cover Type	Structural Stage
Western white pine[1]	Stem exclusion closed canopy[1]
Interior ponderosa pine[1]	Stem exclusion closed canopy[1]
Alpine tundra[1]	Closed low-medium shrub[1]
Whitebark pine-alpine larch[1]	Stand initiation[1] Stem exclusion open canopy[1] Managed young multi-story[1]
Whitebark pine[1]	Stand initiation[1] Stem exclusion open canopy[1]
Interior Douglas-fir[1]	Stem exclusion open canopy[1]
Sierra Nevada mixed-conifer[1]	Stem exclusion open canopy[1]
Pacific ponderosa pine[1]	Stem exclusion open canopy[1]
Cottonwood-willow[1]	Understory reinitiation[1]

[1] Source habitats that have declined substantially in geographic extent from the historical to the current period.

burning sagebrush to prevent invasion of western juniper). This might be an appropriate restoration management action to do in a T watershed; however, a possible consequence is that noxious weeds, such as medusahead, might invade after a prescribed burn because the prescribed burn made the site more susceptible to noxious weed invasion. The prescribed burn action could still be approved, but then another action, weed control, would have to be implemented.

Example 2: Where livestock grazing has not resulted in a loss of geographic extent or decline in the condition of source habitat, livestock grazing may continue as currently implemented. On the other hand, livestock grazing would have to be modified or eliminated where excessive livestock grazing pressure has contributed to a decline in source habitat (for example, livestock grazing that has caused increases in tree density in dry forest types, resulting in a loss of low elevation old forest source habitat [Terrestrial Family 1]).

T-S2. Standard. For land uses conducted pursuant to valid existing rights that pose short- and/or long-term risks to achievement of the T watershed source habitat objectives (T-O1 and T-O2), existing authorities shall be used to mitigate and/or require to the extent authorized design features that would minimize short-term impacts and permit long-term objective attainment.

Rationale: Land management agencies have limited authority to preclude certain activities (such as mining) in priority areas. However, they do have authority to require reasonable terms and conditions or mitigation measures to minimize the effects of some of these uses. This standard requires the use of existing authorities to minimize the impacts of certain uses, over which the BLM and Forest Service have limited authority.

T-S3. Standard. No new road construction shall be allowed in source habitats within T watersheds in the short term (10 years, subject to existing rights) unless needed to secure these areas from immediate adverse road effects or unless the activity is needed to achieve the T watershed objectives.

NOTE: See also:
B-O11 and B-S14 regarding noxious weeds in T watersheds.
B-S5(S2) regarding EAWS in T watersheds.
B-S10 regarding accelerated learning in T watersheds.
R-O15 regarding Subbasin Review and restoration priorities in T watersheds.

Management Direction — Aquatic A1 and A2 Subwatersheds

Description and Management Intent – A1 and A2 Subwatersheds

Aquatic A1 and A2 subwatersheds are one of the components of the aquatic/riparian/hydrologic strategy. These areas provide a system of core subwatersheds (6th-field hydrologic unit codes [HUCs]) that are the anchor for recovery and viability of widely distributed native fishes. They are not intended to be static, long-term reserves, but rather dynamic locations which change in response to new information or changed conditions. The A1 and A2 subwatersheds have many similarities, but they also have a few differences. The similarities are described here; the differences between the A1 and A2 subwatersheds are described in the respective sections.

Both A1 and A2 subwatersheds include important fish populations of one or more of the following:

- Known strong populations for the seven key salmonids (based on 1994 aquatic assessment data),
- Important anadromous fish populations in the Snake River Basin,
- Genetically pure populations of anadromous fish outside the Snake River Basin,
- Fringe populations for four of the key salmonids.

> ***Alternative S2 Only.*** *Both A1 and A2 subwatersheds with listed key salmonid species (bull trout, steelhead trout, stream-type chinook salmon, and ocean-type chinook salmon) have at least 5 percent Forest Service- and/or BLM-administered land. For unlisted key salmonid species (westslope cutthroat trout, redband trout, Yellowstone cutthroat trout), A1 subwatersheds have at least 25 percent Forest Service- and/or BLM-administered land (see Map 3-11).*

> ***Alternative S3 Only.*** *Both A1 and A2 subwatersheds with listed key salmonid species (bull trout, steelhead trout, stream-type chinook salmon, and ocean-type chinook salmon) or unlisted key salmonid species (westslope cutthroat trout, redband trout,*

Yellowstone cutthroat trout) have at least 75 percent Forest Service- and/or BLM-administered land (see Map 3-12).

Alternative S2 Only. *Both A1 and A2 subwatersheds were delineated using broad-scale data. It is intended that administrative units, using the criteria described above, will adjust the A1 and A2 subwatershed locations to incorporate new data prior to the signing of the ROD. In recognition of the dynamic nature of the ecosystem, an agreed upon implementation process for post-ROD adjustments will be developed before the ROD is signed.*

Alternative S3 Only. *Both A1 and A2 subwatersheds were delineated using broad-scale data. Their locations are interim and are intended to be adjusted through land use plan revision or amendment. The criteria for modification will be provided in Forest Service Regional Guides and/or BLM State Director's Guidance or Instruction Memoranda to ensure that the network of habitats is delineated through land use plan revision or amendment.*

Description and Management Intent – A1 Subwatersheds

The intent of management in A1 subwatersheds is to protect important fish populations by conserving and maintaining subwatershed and aquatic habitat conditions, processes, and functions. It is expected that these subwatersheds are currently near attainment of aquatics objectives. These areas are managed to ensure that subwatershed and habitat conditions are protected and maintained to facilitate and contribute to recovery of widely distributed salmonid fish species and other associated aquatic and riparian species. Management activities (for example, noxious weed treatments, prescribed fire and "wildland fire use for resource benefit", non-commercial thinning) within A1 subwatersheds should be designed to pose very low risk of sediment delivery and very low risk of adversely affecting the hydrologic regime and riparian areas. Activities could be initiated in A1 subwatersheds if appropriate and necessary to address substantial and apparent short-term risks to the aquatic and riparian system.

A1 subwatersheds differ from A2 subwatersheds in the status of the land. A1 subwatersheds have at least 50 percent congressionally designated wilderness <u>or</u> predicted road densities of none, very low, or low.

Management direction of A1 subwatersheds will take precedence over other management direction in the ICBEMP project area.

Objectives, Standards, and Guidelines– A1 Subwatersheds

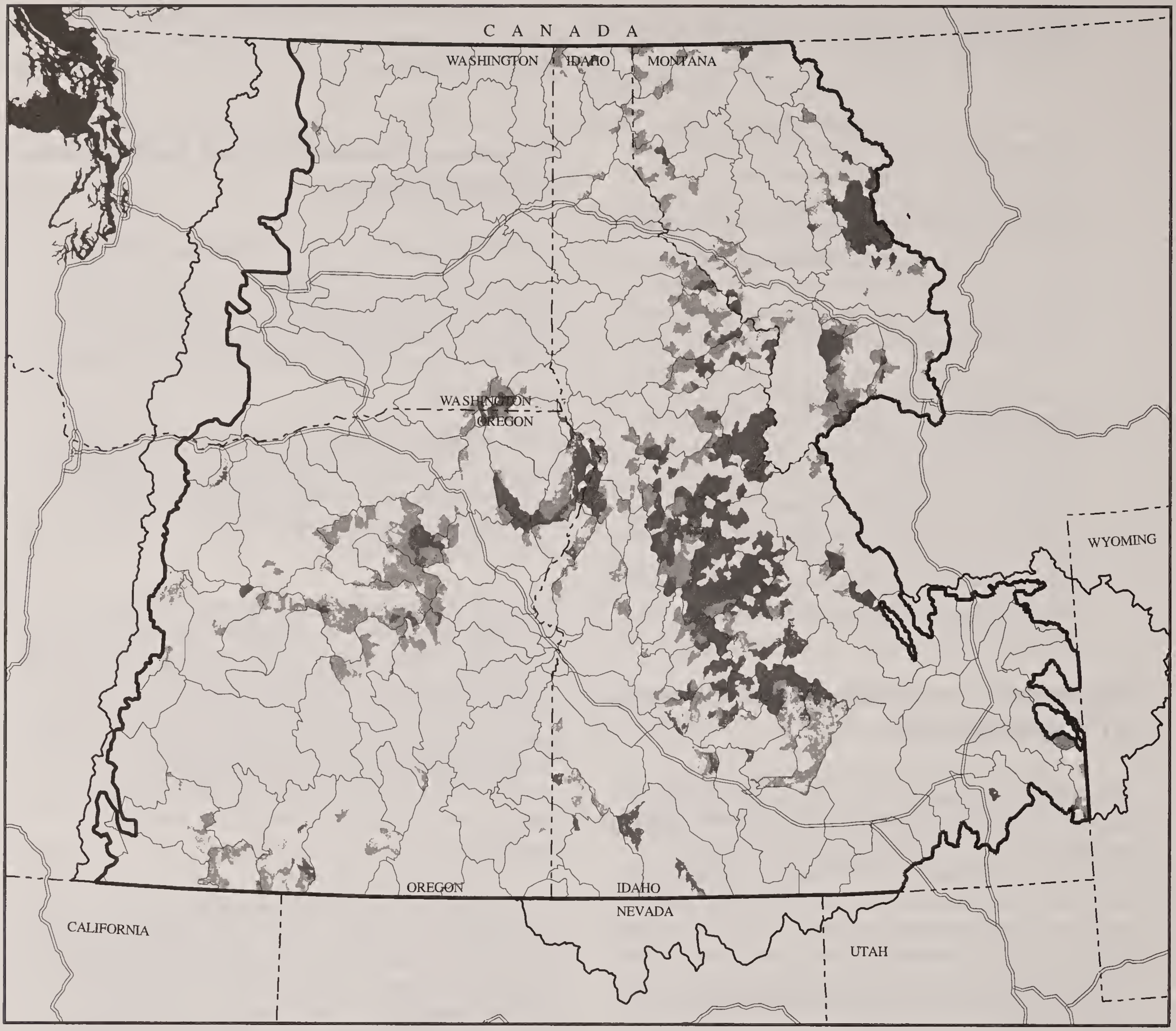
A1-O1. Objective. Conserve current aquatic and riparian habitats that support important native fish population centers. This includes maintenance of hydrologic, riparian, and instream processes and functions; water quality; connectivity; and noxious weeds control.

A1-O2. Objective. Maintain habitats by permitting natural processes, including disturbance events such as fire, to continue whenever these processes will contribute to long-term sustainability of habitat and aquatic/riparian objectives.

Rationale: Disturbance processes, such as fire, can help maintain watershed qualities. Attempts to exclude these processes, such as with fire suppression, may have long-term detrimental consequences (for example, changes in vegetation and successional dynamics, and direct effects of fire suppression itself). "Wildland fire use for resource benefit" and prescribed fire both require extensive planning and documentation and must meet NEPA and agency requirements.

A1-S1. Standard. New management activities (subject to valid existing rights; see standard A1-S4) in A1 subwatersheds shall be conducted only if they maintain or achieve A1 subwatershed and aquatic/riparian/hydrologic objectives and pose very low short-term risk to aquatic, hydrologic, and riparian area functions and processes. Watershed Condition Indicators (WCIs) shall be used to evaluate proposed activities and determine consistency with the aquatic, riparian, and hydrologic objectives (see standard B-S43) and the specific intent of A1 subwatersheds. See the management intent and direction for WCIs for further detail.

A1-S2. Standard. No new road construction shall be allowed within A1 subwatersheds in the short term (10 years; subject to valid existing rights; see standard A1-S4) while A2 subwatersheds and other areas are being restored.



Map 3-11.
Aquatics (A1 and A2) Subwatersheds: Alternative S2

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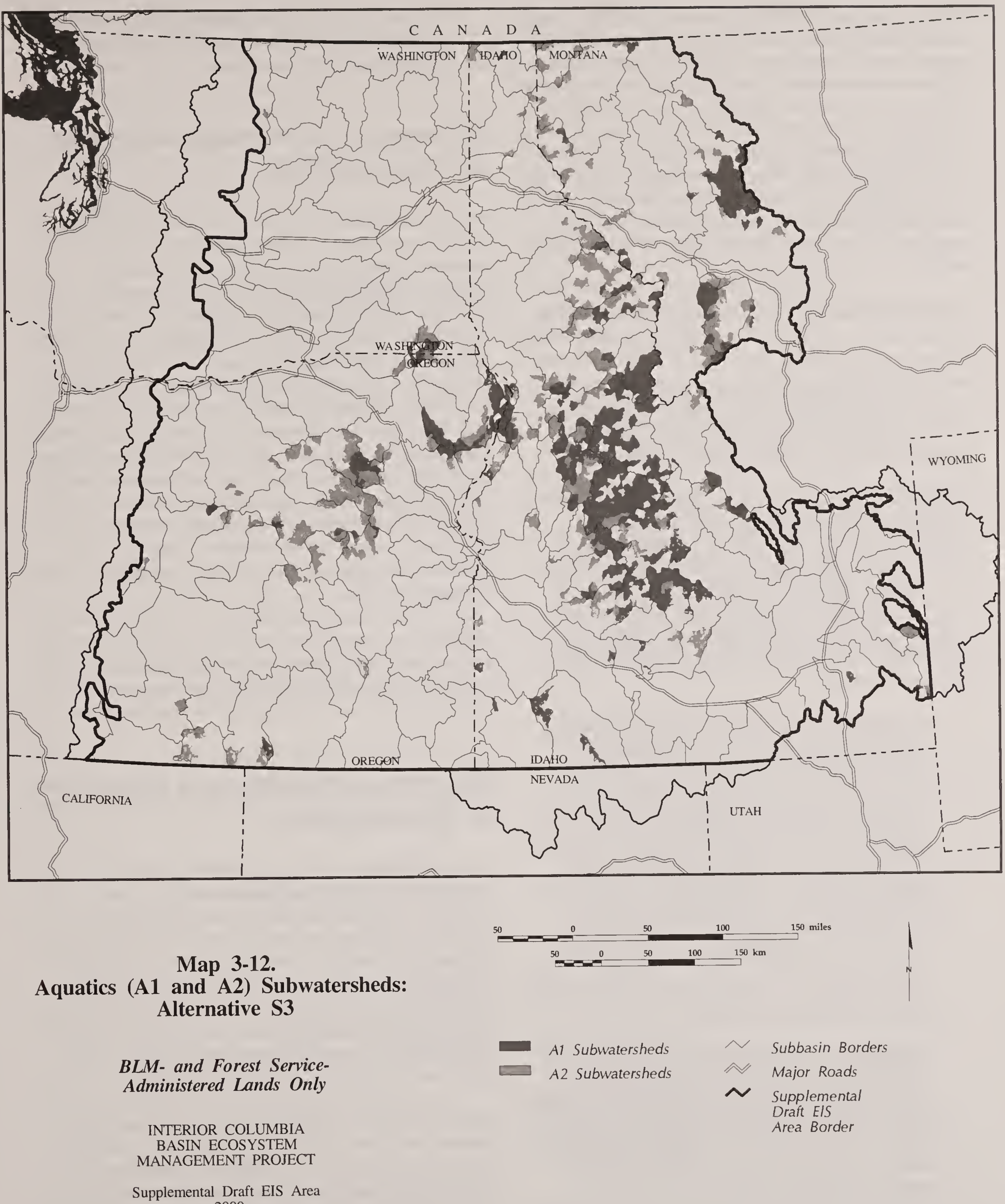

Map 3-12.
Aquatics (A1 and A2) Subwatersheds: Alternative S3

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A1-S3. Standard. Existing land uses, facilities, and actions within A1 subwatersheds shall be modified, discontinued, or relocated (subject to valid existing rights; see standard A1-S4) if they prevent attainment of the A1 subwatershed and aquatics objectives. Watershed Condition Indicators (WCIs) shall be used to evaluate existing land uses, facilities, and actions and determine consistency with the aquatic, riparian, and hydrologic objectives (see standard B-S43) and the specific intent of A1 subwatersheds. See the management intent and direction for WCIs for further detail.

A1-S4. Standard. For those management activities conducted pursuant to valid existing rights that may pose short and/or long term risks to achievement of the A1 subwatershed objective, use existing authorities to mitigate and/or require implementation/design features that would minimize short-term impacts and allow long-term objective attainment.

Rationale: Land management agencies have limited authority to preclude certain activities (such as mining) in priority areas. However, they do have authority to require reasonable terms and conditions or mitigation measures to minimize the effects of some of these uses. Standard A1-S4 requires the use of existing authorities to minimize the impacts of certain uses, over which the BLM and Forest Service have limited authority.

A1-S5(S3). Standard *for Alternative S3 Only* **(no parallel standard for Alternative S2).** The location of A1 subwatersheds can be modified only through land use plan revision or amendment using local data and knowlege. The criteria for modification will include: (1) critical components to be addressed (such as known strong populations of the seven key salmonids), (2) connectivity and distribution of aquatic habitats, and (3) an acreage "limitation" to ensure this component of the integrated broad-scale management strategy stays in balance with other unchanged components.

Rationale: A1 subwatersheds were delineated using broad-scale data. Their locations are interim and are intended to be modified through land use plan revision or amendment using local data and knowledge. The criteria to modify A1 subwater-sheds will be included in Forest Service Regional Guides and/or BLM State Director's Guidance or Instruction Memoranda to ensure that the network of aquatic habitats will be modified consistently through land use plan revision or amendment.

Description and Management Intent – A2 Subwatersheds

Active management is intended to take place within A2 subwatersheds to secure a network of connected habitats. However, management activities (for example, watershed restoration, noxious weed treatments, prescribed and "wildland fire use for resource benefit" [previously referred to as prescribed natural fire], thinning) within A2 subwatersheds are intended to pose low risk of sediment delivery and low risk of adversely affecting the hydrologic regime and riparian areas. It is expected that higher levels of road management and watershed restoration would occur in A2 subwatersheds than in A1 subwatersheds. Since predicted road densities are moderate or higher in A2 subwatersheds, opportunities may exist to access and restore uncharacteristic vegetation patch and pattern while meeting the A2 subwatershed and aquatics objectives.

A2 subwatersheds differ from A1 subwatersheds in the status of the lands. A2 subwatersheds have less than 50 percent congressionally designated wilderness, and moderate, high, or extreme predicted road densities.

Objectives, Standards, and Guidelines– A2 Subwatersheds

A2-O1. Objective. Restore habitats supporting important native fish population centers while minimizing disruption to functioning hydrologic processes. Address immediate risks to hydrologic, riparian, and instream processes; water quality; and connectivity. Integrate needs for terrestrial habitat restoration and restoration of succession/disturbance regimes (such as noxious weed control) that meet the management intent of A2 subwatersheds and that pose low short-term risk to aquatic habitats.

A2-O2. Objective. Maintain habitats by permitting natural processes including disturbance events such as fire to continue whenever these processes will pose low short-term risk and contribute to long-term sustainability of habitat and aquatic/riparian objectives.

Rationale: Disturbance processes, such as fire, can help maintain watershed qualities. Attempts to exclude these processes, such as with fire suppression, may have long-term detrimental consequences (for example, changes in vegetation and successional dynamics, and direct effects of fire suppression itself). "Wildland fire use for resource benefit" and prescribed fire both require extensive planning and documentation and must meet NEPA and agency requirements.

A2-S1. Standard. New management activities (subject to valid existing rights; see standard A2-S4) in A2 subwatersheds shall be conducted only if they achieve A2 subwatershed and aquatic/riparian/hydrologic objectives and pose low short-term risk to aquatic, hydrologic and riparian area functions and processes. Watershed Condition Indicators (WCIs) shall be used to evaluate proposed activities and determine consistency with the aquatic, riparian, and hydrologic objectives (see standard B-S43) and the specific intent of A2 subwatersheds. See the management intent and direction for WCIs for further detail.

A2-S2. Standard. No new road construction shall be allowed within A2 subwatersheds in the short term (10 years; subject to valid existing rights; see standard A2-S4) unless needed to secure these subwatersheds from immediate adverse road effects or unless the activity is needed to achieve the A2 subwatershed and aquatic objectives.

Rationale: The exception in this standard to no new road construction recognizes that construction may be necessary when a road that is causing unacceptable adverse effects has to be obliterated and relocated.

A2-S3. Standard. Existing land uses facilities and actions within A2 subwatersheds shall be modified, discontinued, or relocated (subject to valid existing rights; see standard A2-S4) if they prevent attainment of A2 subwatershed and aquatic/riparian/hydrologic objectives. Watershed Condition Indicators (WCIs) shall be used to evaluate existing land uses, facilities, and actions and determine consistency with the aquatic, riparian, and hydrologic objectives (see standard B-S43) and the specific intent of A2 subwatersheds. See the management intent and direction for WCIs for further detail.

A2-S4. Standard. For those management activities conducted pursuant to valid existing rights that may pose risk to achieving the A2 subwatershed and aquatic/riparian/hydrologic objectives, existing authorities shall be used to mitigate and/or require to the extent authorized implementation/design features that would minimize short-term impacts and allow long-term attainment of objectives.

Rationale: Land management agencies have limited authority to preclude certain activities (such as mining) in priority areas. However, they do have authority to require reasonable terms and conditions or mitigation measures to minimize the effects of some of these uses. Standard A2-S4 requires the use of existing authorities to minimize the impacts of certain uses over which the BLM and Forest Service have limited authority.

A2-S5(S3). Standard ***for Alternative S3 Only*** **(no parallel standard for Alternative S2).** The location of A2 subwatersheds can be modified only through land use plan revision or amendment using local data and knowlege. The criteria for modification will include: (1) critical components to be addressed (such as known strong populations of the seven key salmonids), (2) connectivity and distribution of aquatic habitats, and (3) an acreage "limitation" to ensure this component of the integrated broad-scale management strategy stays in balance with other unchanged components.

Rationale: A2 subwatersheds were delineated using broad-scale data. Their locations are interim and are intended to be modified through land use plan revision or amendment using local data and knowledge. The criteria to modify A2 subwater-sheds will be included in Forest Service Regional Guides and/or BLM State Director's Guidance or Instruction Memoranda to ensure that the network of aquatic habitats will be modified consistently through land use plan revision or amendment.

NOTE: See also:

- **B-O11 and B-S14 regarding noxious weeds in A2 subwatersheds.**
- **R-O25 and associated guidelines regarding Subbasin Review and the A1/A2 network.**
- **R-O26 regarding restoration priorities.**
- **B-S10 regarding accelerated learning in A1/A2 subwatersheds.**

Chapter 4

Environmental Consequences

Contents

Introduction to Chapter 4

Key Terms Used in This Section

Cumulative Effects — Environmental consequences that result from the incremental effects of an activity when added to other impacts of past, present, and reasonably foreseeable future actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time. For this EIS, potential cumulative effects include those that were assessed for all land ownerships including lands administered by other federal agencies and non-federal lands, especially regarding terrestrial and aquatic species.

Direct Effects — Impacts on the environment that are caused by an action and occur at the same time and place as the action.

High Restoration Priority Subbasins — Subbasins in the project area identified by the EIS Team as having broad-scale priority for restoration. The intent for high restoration priority subbasins is to concentrate restoration efforts and make restoration activities effective and efficient. Restoration efforts in these subbasins would be directed toward several purposes concurrently so as to make restoration activities more ecosystem-based and to achieve improvement in several resources at the same time. See Appendix 15 for details.

Historical Range of Variability (HRV) — The natural fluctuation of ecological and physical processes and functions that would have occurred in an ecosystem during a specified previous period of time. In this EIS, refers to the range of conditions that are likely to have occurred prior to settlement of the project area by Euroamericans (approximately the mid 1800s). Historical range of variability is discussed in this document as a reference point only. It establishes a baseline set of conditions for which sufficient scientific or historical information is available, and enables comparison to current conditions.

Indirect Effects — Impacts on the environment that are caused by an action but occur later than or distant from the action, but are still reasonably foreseeable.

Irretrievable Commitments — A term that applies to the loss of production, harvest, or use of natural resources. For example, some or all of the timber production from an area is lost irretrievably while an area is serving as a winter sports site. The production lost is irretrievable, but the action is not irreversible. If the use changes, it is possible to resume timber production.

Irreversible Commitments — A term that describes the loss of future options. Applies primarily to the effects of use of nonrenewable resources, such as minerals or cultural resources, or to those factors, such as soil productivity that are renewable only over long periods of time.

Programmatic EIS — An EIS that provides a broad overview when a large-scale plan is being prepared for the management of federally administered lands on a regional or multi-regional basis. A programmatic EIS provides a valuable and necessary analysis of the affected environment and potential cumulative effects of the reasonably foreseeable actions under that program or within that geographical area. Analyses of lesser scope or more site-specificity may be tiered to the analysis in a programmatic EIS.

Stewardship Harvest — Commercial timber harvest where the primary reason for harvesting timber is to obtain a land use plan objective that requires vegetation manipulation. Therefore, even if the timber could not be sold, the harvest would still take place or be accomplished through other means, such as prescribed fire.

Thinning — An operation to remove stems from a forest for the purpose of reducing fuel, maintaining stand vigor, regulating stand density/composition, or for other resource benefits. Although thinning can result in commercial products,for the purposes of this EIS, thinning generally refers to non-commercial operations.

Traditional Timber Harvest — A commercial operation to remove stems from a forest for the primary purpose of economic gain, with mitigation for other resources (such as forest health or wildlife) secondary in priority.

How the Chapter is Organized

This chapter discloses the environmental consequences of implementing each alternative (described in Chapter 3). It evaluates direct, indirect, and cumulative effects of Forest Service and BLM management on the existing conditions and affected environment (described in Chapter 2). The environmental consequences displayed here are based on the *Science Advisory Group Effects Analysis for the SDEIS Alternatives* (referred to here as *SAG Effects Analysis*, Quigley 1999), along with professional judgement and expertise of the appropriate EIS Team member(s). This chapter forms the scientific and analytical basis for a relative comparison of effects.

For each major component (landscape dynamics [physical setting and terrestrial/upland vegetation], terrestrial species, aquatic–riparian–hydrologic, and social–economic– tribal), key effects and conclusions are presented first, followed by methods of conducting the analysis. Expected direct, indirect, and cumulative effects of the alternatives constitute the major portions of each component discussion. Effects of the four major components are followed by a discussion of effects on factors that influence health of ecosystems, such as fire suppression, insects, and disease. The last section in the chapter provides a cost analysis of the alternatives.

The analysis of effects for each component depends on the scale at which the data were collected and analyzed, and/or the scale most appropriate for displaying differences among alternatives. Consequently, effects are described by one or more of the following:

- Interior Columbia Basin (basin-wide; all lands);
- ICBEMP Project Area (Forest Service- and BLM-administered lands in the project area);
- Ecological Reporting Units (ERUs);
- Resource Advisory Councils (RACs)/Provincial Advisory Committees (PACs);
- Terrestrial Vegetation Communities;
- Potential Vegetation Groups (PVGs);
- Terrestrial Families;
- Counties; or
- Community types.

How the Effects of the Alternatives Were Estimated

Scale of Decision

This analysis addresses large, regional-scale trends and/or major changes in: ecological processes; landscape patterns and structures; succession and disturbance regimes; and habitat availability for threatened, endangered, and sensitive plant and animal species and communities. The analysis specifically focuses on issues that require integrated management across broad landscapes. It also addresses regional-scale trends and changes in the social and economic needs of people, cultures, and communities—both tribal and non-tribal—related to ecological trends and changes. The analysis does not identify site-specific effects, in part because of the level of specificity in broad-scale managment direction, which affects the ability to project effects at that scale; furthermore, site-specific information is not essential to determining broad-scale management direction. Further information on the decisions to be made can be found in Chapter 1 of this EIS.

General Analysis Approach

The EIS Team developed the array of alternatives. The SAG assessed the projected biological, ecological, and socio-economic effects of the Supplemental Draft EIS alternatives, based on a draft (April 1999)of the Supplemental Draft EIS management direction. Their analysis is documented in the *Science Advisory Group Effects Analysis for the SDEIS Alternatives* (Draft, June 25, 1999) (*SAG Effects Analysis*) (Quigley 1999).

To develop their analysis, the SAG developed a set of assumptions, which they coordinated with the EIS Team. Where empirical relationships did not exist to link inputs to outcomes, additional assumptions were developed about those relationships. Assumptions are discussed later in this section and in more detail in Appendix 16.

Major Changes from the Draft EISs

Broad-scale Focus

While the organization of Chapter 4 closely parallels that in the Draft EISs, the content in some places has been changed to reflect the refined focus of the project as described in Chapters 1, 2, and 3; new information from science; comments on the Draft EISs; and/or discussions with tribal and interagency partners. The refined focus addresses a limited number of issues which must be resolved at the basin level. Therefore, some Chapter 4 analyses from the Draft EISs have been dropped if they were determined to be more fine-scale than would be appropriate for the broad-scale focus of this project. All information has been updated and revised as appropriate.

General Analysis Methods

For the Draft EISs, the Science Integration Team (SIT) analyzed the effects of the draft alternatives using, in part, a series of computer models constructed to simulate historical, current, and projected future conditions of the project area. For the Supplemental Draft EIS, the Science Advisory Group (SAG) analyzed the effects of the draft alternatives using, in part, a series of models to simulate the management direction as it would reasonably be implemented during the next decade (short-term) and the next century (long-term). Many of the same models were used in the analysis of both the Draft and Supplemental Draft EISs, but some new models were developed specifically for the analysis of the Supplemental Draft EIS.

No-action Alternative Baseline

In the Draft EISs, the action alternatives (Alternatives 3 through 7) were evaluated against two no-action alternatives (Alternatives 1 and 2) as the baseline condition. Draft EIS Alternative 1 characterized implementation of the pre-1990 Forest and Resource Management Plan; Alternative 2 represented a first characterization of amendments, Eastside Screens, PACFISH, and other interim direction of the 1990s. In the Supplemental Draft EIS, the action alternatives (Alternatives S2 and S3) were evaluated against one no-action alternative (Alternative S1), which is based on the Draft EIS Alternative 2. The Supplemental Draft EIS Alternative S1 represents an updated characterization of interim direction and other amendments of the 1990s based on 10 years of activity data. This resulted in a substantial reduction in many of the activity levels compared to the Draft EISs.

Reporting Units

Effects in the Draft EISs were reported in a variety of units including forest and range clusters and the individual Eastside or UCRB planning areas. The Supplemental Draft EIS does not report effects by clusters or by individual planning areas, but it does include RAC/PACs and Terrestrial Families, which were not used in the Draft EISs. Other reporting units are also used, as appropriate.

Additional changes from the Draft EISs are noted in the individual sections of this chapter.

The SAG and the EIS Team evaluated alternatives on the basis of the data and relationships described in the *Assessment of Ecosystem Components* (Quigley and Arbelbide 1997), which included published research, studies, and reports. Conclusions regarding future conditions were based partly on a series of computer models to simulate the management direction as it would reasonably be implemented during the next decade (short-term) and the next century (long-term). Many of the models were developed as a part of the *Assessment of Ecosystem Components in the Interior Columbia Basin* (Quigley and Arbelbide 1997) or the *SIT Evaluation of EIS Alternatives* (Quigley, Lee, and Arbelbide 1997). Some new models were developed specifically for the analysis of the Supplemental Draft EIS. Inferences were based on available information and model results.

The primary computer simulations were for vegetation, disturbances, activities, and key variables related to landscape conditions. These outcomes and variables were then used as input into other analyses directed toward aquatic, terrestrial, and socio-economic outcomes.

In their *Effects Analysis*, the SAG focused primarily on effects associated with Forest Service- and BLM-administered lands in the project area. The levels of detail presented are the following: at the interior Columbia Basin level (to gain some insights into potential cumulative effects), the ICBEMP project area level (National Forest System and BLM-administered lands to which the EIS and Record of Decision would apply), the Resource Advisory Council (RAC)/ Provincial Advisory Committee (PAC) area level, and/or areas designated for specific purposes (for example, evolutionarily significant units for anadromous fish). For non-Forest Service- and BLM-administered lands in the basin, simulations assumed continuation of existing management direction and

Computer Models

The computer models used in this analysis—like all models of complex biological, physical, social, or economic systems—generally simplify reality because they cannot accommodate all of the interactions between organisms and their environment. Lack of input data stemming from minimal knowledge of many interactions is typically a reason why models must simplify reality. Despite this apparent shortcoming, computer models generally are useful because they can accommodate and analyze many more interactions between organisms and their environment than humans can. Results are repeatable, and models also provide a logic track that scientists and managers can evaluate. Models make it possible to analyze complex alternative management direction, with corresponding changes in model input variables, and to explain the probable biophysical and socio-economic effects of those alternatives.

activity levels. Thus, changes reflect only the effects from implementing the direction contained in the Supplemental Draft EIS.

The *SAG Effects Analysis* describes the likely outcomes and cumulative effects (all lands) from the alternatives across the entire project area and was the basis for this chapter. In those cases where SAG assumptions, models, or simulations were not able to accurately reflect the intent or management direction of the alternatives, the EIS Team further analyzed and disclosed the effects of the alternatives and provided rationale for supplementing or deviating from the SAG evaluation.

Unless otherwise specified, the tables in this chapter were adapted from the *SAG Effects Analysis for the SDEIS Alternatives.*

Incomplete and Unavailable Information

Requirements and Conclusions

The Council on Environmental Quality (CEQ) regulations for implementing procedural provisions of the National Environmental Policy Act (NEPA; 40 CFR 1502.22) require federal agencies to identify relevant information that may be incomplete or unavailable for an evaluation of reasonably foreseeable significant adverse effects in an EIS. If the information is essential to a reasoned choice among alternatives and the cost is of gathering it is not excessive, it must be included or addressed in the EIS.

No missing information was deemed essential to making a reasoned choice among the alternatives being considered at this scale and at this time.

Knowledge is, and always will be, incomplete regarding many aspects of terrestrial and aquatic species, forestlands, rangelands, the economy, and communities and their interrelationships. The ecology, inventory, and management of ecosystems is a complex and developing discipline. However, central ecological relationships are well established, and a substantial amount of credible information about ecosystems in the project area is known. The alternatives were evaluated using the best available information.

The data collection effort for this decision is unprecedented and can generally be categorized into five basic groups (see Appendix 2):

- Databases (more than 20 were acquired or developed);
- GIS themes (more than 180 were compiled or created);
- Expert panels/workshops (approximately 40 were convened for terrestrial, aquatic, and/or landscape science information);
- Contract reports (more than 130 were used); and
- Current literature reviews.

While additional information may add precision to estimates or better specify relationships, new information is unlikely to significantly change the under-

standing of relationships that form the basis of the evaluation of effects. Although new information is welcome, no missing information was deemed essential to making a reasoned choice among the alternatives being considered at this scale and at this time.

Subsequent Analysis Before Projects

This EIS displays management alternatives and likely outcomes for broad-scale management direction. Before site-specific actions are implemented and an irreversible commitment of resources made, information essential to those fine-scale decisions will be obtained by the local managers. Localized data and information will be used to supplement or refine regional-level data and identify methods and procedures best suited to local conditions in order to achieve the objectives in this EIS. Further analyses may be necessary to deal with site-specific conditions and processes. These subsequent analyses will be used to bridge the gap between broad-scale direction and site-specific decisions. These analyses are described in this EIS as "step-down" and are discussed in detail in Chapter 3 and in the Implementation Appendix (Appendix 10).

Monitoring and Review

Appendix 10 provides frameworks for implementation, monitoring, and adaptive management. Should there be new scientific information or a change in conditions not projected under the selected alternative, there are provisions for changing programmatic management decisions to reflect new information and management practices. This process is part of adaptive management and is guided by monitoring, research, and interagency oversight. Adaptive management and monitoring, combined with the NEPA requirement to consider significant new information related to the effects of ongoing actions, reduces the likelihood that incomplete or unavailable information at any point in time would either lead to unacceptable consequences or be considered essential.

Cumulative Effects

Cumulative effects, also called cumulative impacts, are those environmental consequences that result from the incremental effects of an activity when added to other past, present, and reasonably foreseeable future actions regardless of which agency or person undertakes them (see 40 CFR 1508.7). For this EIS, potential cumulative effects include those that were assessed for all land ownerships including lands administered by other federal agencies and non-federal lands, especially regarding terrestrial and aquatic species.

The analysis and disclosure of cumulative effects alert decision-makers and the public to the context within which effects are occurring, and to the environmental implications of the interactions of known and likely management activities. Similarly, programmatic EISs such as this one provide a broad analysis of large areas that encompass many environmental interactions, which would be disclosed as cumulative effects in more site-specific NEPA documents. During subsequent analyses for site-specific activities, local cumulative effects should be important considerations in the design of site-specific alternatives and mitigation measures.

Cumulative Effects on Federal Lands

The alternatives analyzed in this EIS would establish management direction that allows for many activities across lands administered by the Forest Service or the BLM. The consistent management direction of Alternatives S2 or S3 within the project area, combined with subsequent site-specific NEPA analysis and planning, would provide a coordinated land and resource management structure, which itself accounts for cumulative effects of future activities on Forest Service- and BLM-administered lands. In light of the broad geographic scope and spatial resolution of this EIS, the analysis of alternatives could not and does not address all possible cumulative effects that may result at specific sites on federally administered lands.

Subsequent analyses will help to assure that the incremental and interactive effects on Forest Service- and BLM-administered lands in the project area would continue to be considered when implementing the selected alternative. Ground-disturbing actions will be conducted only after site-specific NEPA analysis, if required, which also must analyze the effects of the activity on adjacent lands and resources. Thus, the intent is that managers will design, analyze, and choose the locations and types of site-specific activities that minimize cumulative environmental effects which cannot be described at the broad scale of this EIS.

Cumulative Effects on Non-Federal Lands

For the purposes of this analysis, non-federal lands include lands owned and/or managed by individuals, corporations, American Indian tribes, states, counties, or other agencies. The lead agencies in this EIS (the Forest Service and BLM) do not have the authority to regulate any activities or their timing on lands other than those they administer. However, when an action takes place on BLM- and Forest Service-administered federal land, it may cause direct, indirect, or cumulative effects on non-federal lands. For example, a wildfire that begins on federal land may burn to adjacent private land, or noxious weed infestations that began on private land may infest adjacent federal land; for these examples, direction in this EIS could benefit adjacent landowners indirectly from better controls on noxious weeds and less severe forest fires.

The *SAG Effects Analysis* focused primarily on effects associated with lands administered by the Forest Service and the BLM in the project area. However, analysis was also presented at the basin level, for all land ownerships including lands administered by other federal agencies and non-federal lands, to assess potential cumulative effects, especially regarding terrestrial and aquatic species. These effects are disclosed in individual sections of this chapter.

Cumulative Effects from Non-Federal Actions

This EIS also considers the likely effects on Forest Service- or BLM-administered lands from reasonably foreseeable management actions occurring on non-federal land. For example, management of non-federal land may have potentially direct impacts on terrestrial and aquatic wildlife species that move between federal and non-federal habitats during the year or during their life cycle. The role of management of non-federal lands was considered in the *SAG Effects Analysis* on those species and ecosystems, and is presented in the Terrestrial Species and Aquatics sections of this chapter.

Localized actions on non-federal lands often affect local environmental conditions on nearby federal land and may also affect federal management decisions. For example, non-federal road construction and harvest in a watershed with both federal and non-federal lands could result in a decision by federal managers to postpone harvest to avoid potential watershed degradation. Access to timber on non-federal land may require roads on federal land. However, such actions and their impacts cannot be accurately identified or mitigated in this EIS given its broad scope.

Cumulative Effects in Subsequent Environmental Analysis

Ground-disturbing activities on federally managed lands are conducted only after any necessary site-specific NEPA analysis has been completed. Such analyses are required to describe the cumulative impacts of the site-specific alternatives on adjacent lands and resources, and on the watershed. This provides opportunities to detect and minimize cumulative environmental effects that cannot be specifically determined at the broad level of this EIS.

Other Environmental Consequences

Council on Environmental Quality regulations require discussion of adverse environmental effects that cannot be avoided should the proposal be implemented, the relationship between short-term uses of the environment and the maintenance and enhancement of long-term productivity, and any irreversible or irretrievable commitments of resources which would be involved in the proposal should it be implemented (40 CFR 1502.16). These topics are addressed in this EIS, as necessary, as part of the discussion of environmental consequences for each component of the environment.

Assumptions

As in any analysis predicting the effects of management direction, judgements must be made about the logic that links objectives and direction with actions implemented, monitoring undertaken, and effects projected. The judgements are simpler in small

analyses of single, specific projects; judgements grow more complicated when the analysis encompasses millions of diverse acres and when subsequent analyses and decisions will be made before projects are implemented and effects realized. Assumptions about implementation of direction contained in this Supplemental Draft EIS were developed to reflect consequences of subsequent decisions and effects. As in the analysis of the Draft EIS alternatives, assumptions constitute a given and important facet of the environmental analysis of effects.

The projection of effects by the Science Advisory Group (SAG) was based, in part, on a variety of assumptions about future management conditions that were developed jointly with the EIS Team. This subset of assumptions is included in Appendix 16.

In addition, the SAG made assumptions regarding relationships among ecosystem components where definitive empirical studies do not exist, and concerning probable outcomes from implementing management activities or from succession/disturbance processes. The models that were used by SAG have additional inherent assumptions. Some of those assumptions are included in Appendix 16, and the rest are documented in the *Science Advisory Group Effects Analysis for the SDEIS ALternatives* (Quigley 1999).

Included in Appendix 16 are those assumptions that clarified interpretation of direction, intent, and/or rationale; provided enough detail to derive outcomes for viability determinations for species of broad-scale concern; and described reasonable implementation for elements not fully described in the supplemental Draft EIS, such as implementation strategy, step-down processes, monitoring strategy, data management, and technology transfer.
The EIS Team provided storylines, budget estimates, and allocation priorities that were not part of the Supplemental Draft EIS direction but were key to the modeling exercise. The assumptions draw directly from the intent; process descriptions; specific standards, objectives, goals, guidelines; and storylines associated with each Supplemental Draft EIS alternative. The intent of assumptions is not to artificially restrict management to achieve the most favorable of outcomes; rather, the intent is to establish the clarity necessary for analysis purposes in the evaluation of the alternatives.

Because of the full suite of assumptions necessary to project effects (including those presented in Appendix 16 and those documented in the *SAG Effects Analysis*), a level of uncertainty is associated with the projected effects. As in any analysis, there is risk associated with the projections of effects if the assumptions are in error and/or if the assumptions do not hold into implementation. Adaptive management and monitoring (particularly validation and effectiveness monitoring) are designed to ensure that managers are able to adjust if effects were not accurately portrayed for a variety of reasons, including errors in assumptions.

Key general assumptions included the following:

- Regulatory agencies will be staffed with adequate expertise and resources to participate in a timely and effective manner as interagency partners in implementation and monitoring.
- The manner in which available funds are allocated across the project area and among possible treatments affects the degree to which the achieved outcomes reflect the outcomes projected in this chapter. Implementation of the action alternatives presumes funds are focused on the restoration work identified as priority, through management direction (such as specific objectives) or designation (such as in an A2 subwatershed). It is assumed that changes from current practices for handling funding allocations will occur, with priorities for funding requests and allocations collaboratively set at the regional and subregional scales. Any projected improvements in ecological conditions in this chapter associated with Alternatives S2 and S3 presume a change to a more broad-scale approach that considers priorities among and between administrative units.
- BLM and Forest Service administrative units will have appropriate expertise and experience in-house (through service centers) or through contracting available to them to effectively implement and monitor the EIS direction. Line officers will ensure necessary training, including technology transfer, is provided in a timely manner and as needed, through mechanisms such as those already in place (for example, certification programs, RIS teams) or through new mechanisms designed to fill training gaps.
- Practices used to implement Alternatives S2 and S3 of the Supplemental Draft EIS are based on ecological goals and objectives. Current practices (Alternative S1) have moved toward more ecological practices but still are more focused on traditional practices.
- Subbasin review/analysis and/or ecosystem analysis will be the primary vehicle(s) for setting landscape/project goals and objectives for Alternatives S2 and S3, although in some cases similar results can be achieved through programmatic processes such as range allotment planning or large-scale prescribed fire planning. Subbasin review/analysis and/or ecosystem analysis combined with NEPA analyses will be used to determine acceptable practices to achieve the objectives.

- An implementation strategy will provide more definitive guidance to the field regarding how to implement the selected alternative.
- A monitoring strategy will be developed to accompany the implementation strategy. It will include a hierarchical approach.
- The prescription emphasis as brought forward in the Landscape Ecology modeling for the alternatives represents a reasonable simulation of the alternatives. This modeling was based on the Chapter 3 direction package and the EIS Team storylines.
- Several assumptions regarding road management and road density changes were necessary to predict effects. It was assumed that the current national process for road policy being conducted by the Forest Service will be brought to a conclusion in the next several years. The outcome will be analysis requirements and the need for additional justification for constructing new roads. The SAG assumed that it will slow the rate of growth of new roads on Forest Service-administered lands in both the short and long terms. The SAG assumed that the existing minimal level of road construction on BLM-administered lands will continue.
- It is estimated that very little change in road density classes will result for any of the alternatives for the first decade (because of the large number of road closures or new roads it would take to move a road density class from its current class).
- The project has compiled activity level data (prescribed fire, wildfire, timber harvest, timber volume, and authorized AUMs) for each administrative unit in the project area for 1988 through 1997. These data are used to assign a base landscape modeling prescription that is calibrated to the current level of activity by administrative unit. These data are assumed to reflect current management levels and are based on individual land use plans, recovery plans, and eastside screens.
- It is assumed that there will be an organizational structure in place for implementation of the Record of Decision (ROD). The actual structure is yet to be defined, but will be based on the preliminary decisions of the ESC. It is expected to include structures appropriate to address basin oversight, monitoring, data management, subregional analysis, coordination, dispute resolution, science advice, and technology transfer. Details on location, membership, and duties of implementation teams are assumed to be developed prior to beginning actual implementation. The subregional organization is expected to align with modified RAC/PAC areas.

Budget Assumptions

Modeling the effects of the management direction of Chapter 3 required an assumption of certain amounts of restoration activities. Accomplishment of restoration actions (such as precommercial thinning or prescribed burning) requires funding. The total funding available for the land management agencies within the project area is estimated to be $540 million for both BLM ($70 million) and the Forest Service ($470 million). While the total funding available to BLM and Forest Service managers in the project area is subject to the influence of EIS direction, some of that funding is directly expended on restoration activities to move existing resource conditions toward a more desirable condition. This is the amount of funding used in the models to project outputs (such as board feet) and outcomes (such as ecosystem condition) for the effects section of this EIS. Alternative S1, the no-action alternative, assumes the availability of current funding for on-the-ground restoration actions ($135 million per year). Alternative S2 assumes approximately $202 million in funds expended on restoration actions each year. Alternative S3 assumes $182 million in funds expended on restoration actions each year.

Each alternative also estimates the cost of newly required step-down analyses (in addition to those already accomplished through programmatic planning processes and/or through compliance with NEPA and project consultation under Section 7 of the Endangered Species Act). These adjustments would reduce the annual funding to support restoration actions by $18 million for Alternative S1, by $13 million for Alternative S2, and by $9.5 million for Alternative S3.

The allocation of funding among management actions and among administrative areas is responsive to the integrated broad-scale management direction for each alternative at any funding level. The funding allocation varies with the management strategies within each alternative and is particularly affected by the differential management priorities within each alternative. The intent of the budget allocations within Alternatives S2 and S3 differs from that of Alternative S1. In particular, the funding allocation in Alternatives S2 and S3 is focused by the management priorities expressed in the terrestrial T watersheds, the aquatic A1/A2 subwatersheds, and high restoration priority subbasins and other priority designations. As noted in the previous assumptions section, the projected improvements in ecological conditions presume an ability to focus funding to priority areas.

Management Strategies and Budget Sensitivities

To facilitate selection of a preferred alternative for the Supplemental Draft EIS, the EIS Team and SAG analyzed the sensitivity of the three alternatives to varying levels of funding for restoration activities. The alternatives are compared at two funding levels: "current" and "increased." *Current* funding is approximately what the land management agencies have been spending for on-the-ground restoration activities in recent years (Alternative S1). This is a subset of the total budget for Forest Service and Bureau of Land Management administrative units in the project area as discussed in the previous section. *Increased* funding is a $67 million (Alternative S2) and $47 million (Alternative S3) increase over the total funding for these land management agencies in the basin.

For each of the three alternatives, sensitivity to funding was evaluated for strategies that address: landscape health, wildfire, old forest protection and restoration, livestock grazing, terrestrial species habitat protection and restoration, aquatic and riparian habitat protection and restoration, county and community socio-economic outcomes, tribal treaty and trust responsibilities, road management, and noxious weeds management. These management strategies were analyzed at current and increased funding levels.

The analysis of the sensitivity of management strategies came to the following general conclusions:

- All outcomes are significantly affected by the differences in the design of the management strategies for each alternative. This is not an unexpected conclusion. Each alternative is designed to address the critical and compelling basin-wide issues in a different way. This becomes most clear when alternatives are compared at the same funding level. Projected outcomes also vary by budget level. The strategies used in each alternative to address various issues are not uniformly sensitive to budget levels.
- There are two situations wherein outcomes generally *are not* affected by funding:

  First, outcomes are *least responsive* to shifts in budget levels where management direction restricts human actions. This holds when the existing condition can be maintained and/or the desired future condition achieved through restrictions rather than management analysis or activities to achieve desired outcomes.

  Second, outcomes for some management strategy components are not sensitive to budget levels if effective treatments are not available to reverse trends at the landscape level or if interactions among other management strategy components keep the overall outcome from changing significantly. In other words, outcomes are not sensitive to budget where no reasonable investment could change trends or current status. Alternatives S2 and S3 strive to avoid this situation by prioritizing restoration activities intended to reverse trends in places where there is the opportunity to "make a difference." Alternative S1 does not have that prioritization strategy at the basin scale.
- Considering critical and compelling issues within the basin, investments in on-the-ground management activities change outcomes but rarely shift the ranking of outcomes across the alternatives. If a strategy is ranked "better" or "more effective" at current funding for an alternative, it is also ranked "better" or "more effective" with increased funding. In some cases, expending more funds to accomplish "xx" activity may result in more of "yy" outcome. Such outcomes *are* considered sensitive to budget levels. However, even when this is the case, the ranking of alternatives for any given outcome or issue does not change.
- Increased budget levels result in substantially improved conditions for those issues that benefit from active restoration. The level of benefit achieved is strongly related to the strategy underlying each issue within an alternative. Thus, from an ecological perspective, the underlying strategies for the various issues are a stronger determinant of ranking among the alternatives than is budget level.
- The underlying socio-economic strategies and outcomes of the alternatives are also a stronger determinant of ranking among the alternatives than is budget level.
- Generally, passive approaches to restoration do not lead to the highest degree of attainment of most Supplemental Draft EIS objectives in the short or long term. Because of current conditions and the dynamic nature of the ecosystems and their inherent disturbances, ecological restoration objectives depend on investments in management actions aimed at achieving desired outcomes that are not likely to occur through natural processes (for example, wildfires may reset vegetation densities but in ways that adversely affect forest productivity, sediment, and species habitats).

Landscape Dynamics Component: Physical Setting

This section presents the effects of alternatives on soils, hydrology and watershed processes, and air quality. A summary of key effects for all sections is presented first. Each subject area then presents methods for determining effects, and effects of the alternatives.

Summary of Key Effects and Conclusions

Over the long term, Alternative S2 would better maintain and restore soil productivity, hydrologic functions, and watershed processes than Alternative S3, followed by Alternative S1. Alternative S2 would also maintain riparian ecological functions better than Alternatives S3 and S1. Alternative S1 would have greater total impact on air quality because of smoke from large wildfires; prescribed fire activity under Alternatives S2 and S3 would generate more frequent but lesser amounts of smoke in the short term and would have lower total air quality impact in both the long and the short term than Alternative S1.

Soil Functions and Processes, including Soil Productivity

- The majority of Forest Service- and BLM-administered lands would be in the low and very low soil disturbance category for all alternatives over the next 100 years. No decreases in long-term soil productivity would result from implementing any of the alternatives.
- Activities in the high restoration priority subbasins for Alternatives S2 and S3 are predicted to cause a slight change of land from none, very low, or low soil disturbance to moderate levels. These increases would not result in decreases to long-term soil productivity because restoration activities are designed to resemble soil disturbance effects that would be expected under natural disturbance processes.
- In the high restoration priority subbasins, reductions in negative effects from uncharacteristic wildfire and livestock grazing would provide benefits to soil productivity over the next 100 years.
- Snags and large downed wood are key components in maintaining and restoring soil functions and providing for soil productivity over the long term. Alternative S2 places the most emphasis on increasing snag numbers for the long term. Large downed wood is currently above historical levels on most forested lands and would increase under all alternatives. Alternative S2 is predicted to be slighly more effective than Alternatives S3 and S1 in using prescribed fire to manage for desirable concentrations of large downed wood.
- Over the next 100 years Alternative S2 would provide more maintenance and restoration of soil productivity than either Alternative S3 or Alternative S1 because of its decreased rate of departure from historical range of variability (HRV).
- Predicted decreases in road-related adverse effects would be beneficial for the long-term recovery of soil productivity by re-establishing soil functions and processes. Benefits to soil productivity would be highest under the intensive restoration emphasis of Alternative S2, followed by Alternative S3 then Alternative S1.

Hydrology and Watershed Processes

- Alternative S2 would maintain or slightly restore hydrologic functions and watershed processes better than Alternative S3 as a result of activities implemented to decrease the rate of HRV departure. Alternative S1 is not expected to decrease the rate of HRV departure; therefore, trends for hydrologic function and watershed processes are predicted to gradually worsen over the long term.
- Alternative S2 would reduce adverse effects from uncharacteristic wildfire, slightly better than Alternative S3, and would provide higher protection and maintenance of hydrologic function and watershed processes. The management approach to wildfire in Alternative S1 would do little to protect and maintain hydrologic function and watershed processes.
- Livestock grazing effects would trend toward historical, the strongest in Alternative S2 and slightly less so in Alternative S3; this would lead to increased maintenance and restoration of hydrologic function and watershed processes. With regard to effects from livestock grazing, Alternative S1 would not provide the same level of improvements to hydrologic function and watershed processes compared to Alternatives S2 and S3.

- The predicted trends in soil disturbance indicate that current levels and conditions for hydrologic function and watershed processes would be maintained for all alternatives over the next 100 years.
- Road density trends for Alternative S1 are estimated to remain static in the long term. The restoration emphasis of Alternatives S2 and S3 would result in higher decreases in road densities than Alternative S1. Decreases in adverse road effects with short- and long-term benefits to hydrologic function and watershed processes would be highest for Alternative S2, then Alternative S3 and Alternative S1, respectively.
- Higher levels of landscape restoration would occur in the high restoration priority subbasins in Alternatives S2 and S3. Activities would contribute to the restoration of integrated ecological processes. Activities such as those planned under the high restoration strategy are more likely to be successful in protection, maintenance, and restoration of watershed processes at the broad scale compared to Alternative S1.
- Alternative S2 would maintain riparian ecological processes through time and would contribute most to protecting, maintaining, or restoring watershed processes and hydrologic function, more so than Alternatives S3 and S1.
- The higher rate and frequency of hierarchical step-down analysis under Alternatives S2 would be more likely than Alternatives S3 and S1 to protect and restore hydrologic function and watershed processes, using an integrated landscape approach.

Air Quality

- The dispersion modeling assessment indicates that there may be significantly greater impacts on the National Ambient Air Quality Standards (NAAQS) from wildfires than from prescribed burning.
- Modeling of emissions from prescribed burning suggests that at a coarse scale (20 km and 4 km grids) NAAQS would not be violated (averaged across the 20 km grid). However, compliance with the NAAQS at a local level must be evaluated at subsequent planning levels to assure they are not violated.
- Increased short-term haziness (a reduction in viewing distance and ability to detect finer features on the landscape) would likely result from the increased use of prescribed burning in Alternatives S2 and S3. It can be inferred that because of higher concentrations of emissions associated with wildfires, the magnitude of visibility impairment from wildfires would be greater than the highest levels of prescribed fire used in Alternatives S2 and S3. However, a higher frequency of lower visibility impacts can be expected from prescribed fire than wildfire.
- Other criteria pollutants produced from prescribed fire are not likely to have an impact on public health because of the small levels produced, distances to populated areas, and the rapid dilution or modification of these substances within relatively short time frames.
- The dispersion modeling suggests that, in a relative sense, the magnitude of the short-term impacts from wildfire emissions will likely be greater than impacts from prescribed burning emissions, although the frequency of prescribed burning impacts may be greater than the frequency of wildfire impacts.
- Alternatives S2 and S3 would allow an opportunity to reduce fuel accumulations across the landscape and lessen the impacts from wildfire. An analogy would be that prescribed fire acts as a "pressure relief valve" for wildfire.

Soil Functions and Processes, Including Soil Productivity

Methodology: How Effects on Soils and Soil Productivity were Estimated

The Science Advisory Group (SAG) modeled the effects of the alternatives by developing management prescription scenarios. The EIS Team evaluated modeled outputs for certain landscape variables to provide both quantitative outcomes and qualitative interpretations for effects on soils and soil productivity. Quantitative outcomes were derived from modeled variables that are directly related to soil productivity. Qualitative interpretations were made for variables that were not directly modeled for effects on soils. The qualitative interpretations provide an estimate of the effects on soil productivity based on the trends of the variable. Effects for each alternative are described by comparing the relative changes expected from either of the action alternatives (S2 and S3) to the no-action alternative (S1).

Landscape variables as indicators of soil productivity are not reported at levels below the subbasin scale. Application of the interpretations and findings below the subbasin scale are not appropriate in determining effects of the broad-scale management direction. For further information on disturbances, assumptions, and methodology, refer to the *Landscape Effects Analysis of the SDEIS Alternatives* (Hemstrom et al. 1999). Additional information and assistance in interpretation of the *SAG Effects Analysis* was acquired through discussions with Forest Service research scientists (personal communications, J. Clayton, Soil Scientist, Intermountain Research Station; and A. Barta, Geomorphologist, Intermountain Research Station).

The following variables were selected to describe the potential effects of the alternatives on soil functions and processes, including soil productivity.

Quantitative Outcomes

Soil Disturbance

The term 'soil disturbance' will be used to describe the effects of the alternatives on soil productivity. The quantitative data used to characterize soil disturbance effects are derived from the uncharacteristic soil disturbance variable developed by the SAG.

In the *SAG Effects Analysis,* uncharacteristic soil disturbance is defined as an effect caused by reduced vegetation/litter cover, loss of root binding capability, and increased erosion, compaction, and stream bank failure. Disturbances that create these effects can result in loss of upland and riparian soil productivity and accelerated sediment delivery to aquatic systems. The occurrence of actual surface soil disturbance and erosion depends on the combination of the type of soil disturbance with sensitive soil and watershed conditions, and the associated cumulative effects over time. Modeled outcomes for the uncharacteristic soil disturbance variable are based on the likelihood of prescribed activities (timber harvest, thinning, prescribed natural fire, and prescribed fire) to cause uncharacteristic, detrimental effects that can lead to loss of soil function and soil productivity. Soil disturbance effects caused by livestock grazing, roads, and wildfire are purposely excluded from uncharacteristic soil disturbance because those effects are predicted in those respective variables.

The model puts Forest Service- and BLM-administered lands into one of six classes describing different levels of uncharacteristic soil disturbance (none, very low, low, moderate, high, or very high).

According to the definitions for the uncharacteristic soil disturbance categories, the none, very low, and low classes result from infrequent to frequent, low impact disturbances and soils recover to normal conditions in a relatively short time. It is unlikely that extensive cumulative effects would ensue; therefore, these soil disturbance effects generally would not negatively affect soil productivity. Soil disturbance effects in the none, very low, and low classes equate to effects that would be expected under natural disturbance regimes and events for most landscapes in the project area. Conversely, uncharacteristic soil disturbance in the moderate or higher classes is associated with frequent, high

impacts which are likely to cause cumulative effects. These soil disturbance effects would be detrimental to the physical and biological soil properties and functions that can lead to the loss of soil productivity. Complete definitions of uncharacteristic soil disturbance classes can be found in Hemstrom et al. (1999).

Because of potential for confusion or inconsistencies in the presentation of the outcomes for uncharacteristic soil disturbance, the term soil disturbance will be used in the remainder of this environmental consequences section to describe the effects of the alternatives on soil productivity, hydrology and watershed process, and water quality.

Rationale for Qualitative Interpretations of Modeling of Management Alternatives

Livestock Grazing and Uncharacteristic Wildfire

Effects from these variables are likely to occur across large areas and could result in loss of vegetation, litter cover, and root binding capability, increased soil erosion and streambank failures that lead to reductions in riparian and aquatic habitat conditions. Trends for these management-related variables were interpreted to qualitatively estimate potential or expected effects on soil functions and processes, and long-term changes in soil productivity.

Large Snags and Large Downed Wood

Standing snags and downed woody material are necessary components of ecosystem function and sustainability. Activities that remove organic matter, large snags, and large downed wood below levels under which soils evolved on that site can cause declines in soil productivity. For soils to be productive at a particular site, downed woody material and organic matter must be maintained, and where necessary restored, to levels under which those soils evolved.

This variable was not modeled to directly determine effects on soils; however, snags and large downed wood play a key role in maintaining and restoring soil productivity on forested lands. Modeled outcomes that predict changes in trends for the large snag and large downed wood variable were qualitatively evaluated for each alternative to estimate long-term effects on soil productivity.

Historical Range of Variability (HRV) Departure

This variable integrates the collective departure (or change) of vegetation pattern, composition, and structure, and disturbance regimes from historical ranges, providing outcomes for both forest and rangelands. Long-term changes in vegetation pattern, composition, and structure, and disturbance regimes have modified the ecological function and natural properties of upland and riparian soils. Activities designed to decrease the rate of change from HRV would provide benefits to upland and riparian soil resources.

Landscape conditions representative of those under which soils evolved determine the likelihood for soil nutrients to be available and sustainable through time. Landscape patterns and conditions that are within or trending toward the historical range of variability are more likely to have intact soil functions and processes that provide for long-term sustainable soil and site productivity. The modeled outcomes describing the trends in HRV departure from historical conditions were qualitatively evaluated for each alternative and used to describe long-term trends for soil productivity.

Predicted Road Density Classes and Trends

Past and current road construction and maintenance activities (or their lack) have increased surface erosion and contributed to persistent declines in long-term soil productivity. Road closure and removal and similar restoration activities can reduce erosion from existing roads and provide a healthy medium for plant growth. Modeled changes in road density trends resulting from implementing ICBEMP road management direction are predicted to aid in the restoration and protection of soil functions and processes and result in the long-term restoration and maintenance of soil productivity. Qualitative interpretation of these trends was used to estimate the restoration and maintenance of soil functions and processes and long-term trends for soil productivity.

Effects of the Alternatives on Soil Functions, Processes, and Productivity

Effects of the alternatives on soil functions and process, including soil productivity, are most directly related to the uncharacteristic soil disturbance variable; therefore, a quantitative evaluation for those outcomes is presented first. Following that are qualitative interpretations for effects on soil productivity based on predicted trends for uncharacteristic wildfire and livestock grazing effects; large snags and large downed wood; departure from historical range of variability; and trends in road densities.

Soil Disturbance

The relative changes in soil disturbance classes comparing each alternative to current conditions are displayed graphically in Figure 4-1. Long-term estimates for acres in each soil disturbance class are listed in Table 4-1. The acre values are presented graphically as a percent of the total Forest Service- and BLM-administered land in Figure 4-2.

There is a significant decrease in the amount of land in the *none* class for all alternatives compared to current conditions. When compared to current conditions, the none class for Alternative S1 (-81 percent) would decrease approximately five percent more than Alternatives S2 and S3 (-76 percent). For Alternative S1 this decrease would be from the continuation of traditional management approaches that do not incorporate integrated restoration concepts. The decrease in the none class for Alternative S1 corresponds primarily to increases in the very low and low disturbance classes. For Alternatives S2 and S3 the decrease in the none class would be less than Alternative S1, likely the result of implementing intensive restoration activities. For Alternatives S2 and S3 the projected decrease in the none class corresponds to the increase in acres in the low disturbance class.

Alternative S1 is predicted to increase in the *very low* and *low* classes. Alternatives S2 and S3 are predicted to have decreases in the very low class and increases in the low class. According to SAG, changes of less than two percent are insignificant, which applies to outcomes for the moderate, high, and very high classes for all alternatives. Overall, these data indicate that Alternatives S2 and S3 would have similar trends in soil disturbance. Figure 4-3 illustrates soil disturbance in Alternatives S2 and S3 as percent change from Alternative S1.

Activities implemented in Alternatives S2 and S3 would be mitigated to not generate soil disturbance effects above the low class. Similarly, activities implemented under Alternative S1 would mostly result in low and very low soil disturbance effects. A key finding from the *SAG Effects Analysis* is that very low and low classes for soil disturbance are associated with infrequent, low-to-moderate-impact activities. The recovery time to return the soil surface to pre-activity conditions for these classes is relatively short, and disturbances are unlikely to cause extensive cumulative effects.

Table 4-1. Soil Disturbance Class, Acres,[1] and Percent Change from Alternative S1.

Soil Disturbance Class	Current Acres	Alternative S1 Acres	Projected Condition at 100 Years: Alternative S2 Acres	Alternative S2 % Change from S1	Alternative S3 Acres	Alternative S3 % Change from S1
None	1,520,000	248,000	314,000	27	314,000	27
Very Low	40,734,000	40,912,000	38,960,000	-5	39,060,000	-5
Low	16,439,000	17,495,000	19,368,000	11	19,268,000	10
Moderate	3,659,000	3,700,000	3,701,000	<1	3,707,000	<1
High	1,155,000	1,151,000	1,162,000	1	1,157,000	<1
Very High	59,000	60,000	60,000	no change	60,000	no change

[1] Forest Service- and BLM-administered lands in the project area, rounded to nearest 1,000.

Source: Hemstrom et al. 1999

High Restoration Priority Subbasins

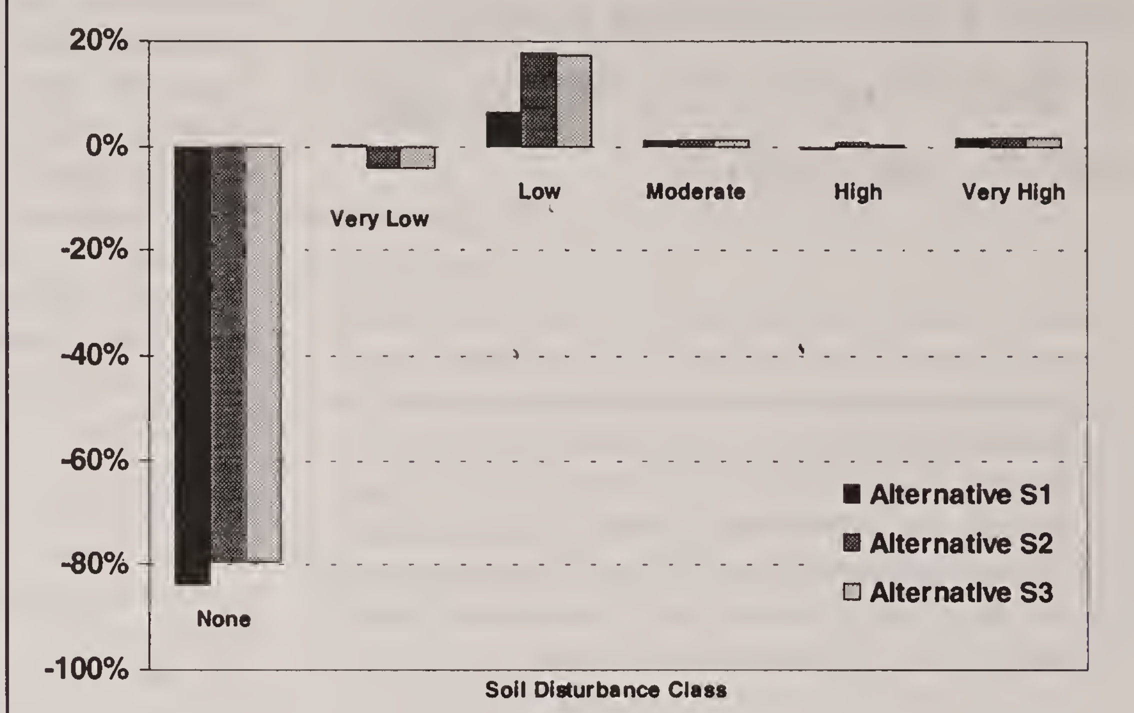


Figure 4-1. Soil Disturbance, Percent Change from Current at 100 Years.

For Alternatives S2 and S3, the planned amounts of harvest and restoration, thinning, and prescribed fire would increase by two- to ten-fold in the high restoration priority subbasins. This is logical considering the high restoration priority subbasins are not a component of Alternative S1. The level of disturbance in Alternative S2 is predicted to be higher than in Alternative S3. This may suggest a higher degree of impairment to soil functions and processes and soil productivity. However, the design and implementation of landscape level restoration treatments are assumed to achieve effects similar to those occurring under historical disturbance patterns. The disturbance effects resulting from priority restoration activities are predicted to have less impact and be less severe than fire effects and erosion caused by past fire exclusion and traditional management activities. Furthermore, monitoring and evaluation, integrated with an adaptive management approach, would result in adjustment of treatment design and imple-mentation to reduce soil disturbance to levels similar to historical conditions.

The restoration strategy identifies more area as priority for restoration in Alternative S3 than Alternative S2; however, fewer acres are actually treated in Alternative S3 than in Alternative S2. Integrated landscape restoration activities in both alternatives are predicted to cause a slight change of category from none, very low, or low soil disturbance to moderate levels. The total amount of Forest Service- and BLM-administered lands in these subbasins that experience an increase in soil disturbance would remain below one percent for Alternatives S2 and S3.

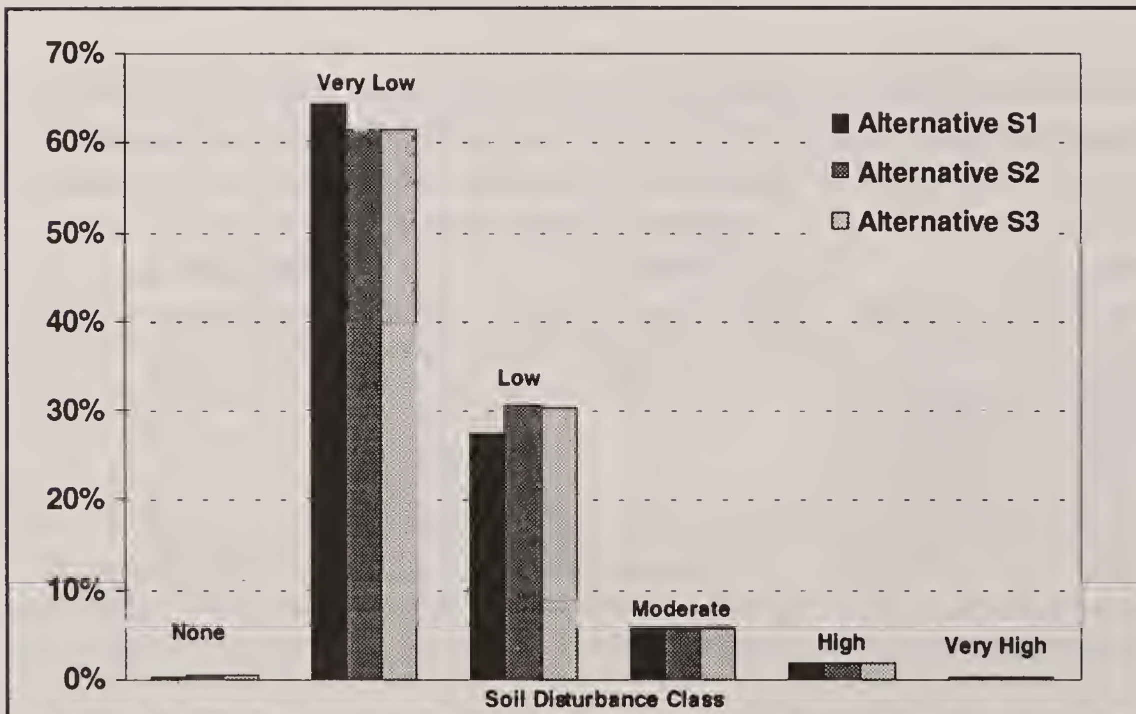


Figure 4-2. Soil Disturbance, Percent of Project Area at 100 Years.

In the long term the majority of Forest Service- and BLM-administered land would remain in the very low and low soil disturbance categories for all alternatives, and effects from prescribed activities would remain relatively constant over the next 100 years (Figure 4-2). Using the quantitative outcomes for soil disturbance, it can be concluded that effects on soil functions and processes would be very similar, almost non-detectable at the broad scale, for all alternatives. No adverse effects on soil processes are predicted and no decreases in long-term soil productivity would result from implementing any of the alternatives.

Uncharacteristic Wildfire and Livestock Grazing Effects

Not all disturbances that have potential to negatively affect soil productivity are evaluated in the preceding analysis, and not all disturbances have the same effect on soil properties. Effects from uncharacteristic wildfire and livestock grazing can result in varying amounts and distributions of soil disturbance that can affect soil productivity.

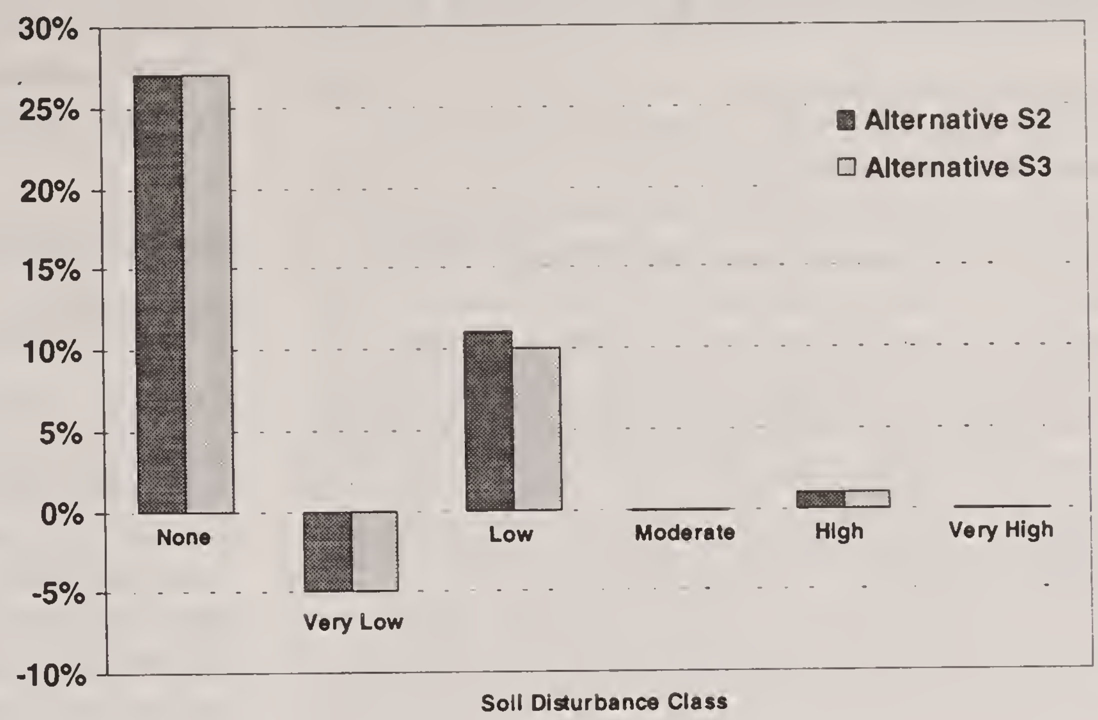


Figure 4-3. Soil Disturbance, Percent Change from Alternative S1.

Uncharacteristic Wildfire

Wildfire can profoundly reduce soil productivity when burned areas have a high percentage of water-repellent soil conditions, and high rates of increased soil erosion will ultimately occur if intense rainstorms follow. Forest and rangeland fuels reduction activities are predicted to have similar effects for all alternatives in reducing the percentage of uncharacteristic wildfire on Forest Service- and BLM-administered lands from very high and high to a low probability.

When comparing the alternatives relative to the high restoration priority subbasins, Alternatives S2 and S3 should reduce the area of Forest Service- and BLM-administered lands that experience uncharacteristic wildfire over 100 years by 57 percent and 40 percent respectively. Because Alternative S1 does not have an integrated restoration strategy, this alternative would do little to alter the pattern and amount of uncharacteristic wildfire. Effects on soil functions and processes as a result of wildfire, including increased levels of soil erosion, are estimated to return to near historical ranges in the high restoration priority subbasins under Alternatives S2 and S3.

Livestock Grazing Effects

Soil disturbance from livestock grazing effects (see definitions in livestock grazing section) was qualitatively assessed by looking at reductions in native species habitat quality, vegetation and litter cover, root binding capacity, and riparian conditions.

Loss of soil productivity as a result of livestock grazing effects can be caused by:

- Compaction of soils in areas of high use or on water-saturated soils;
- Removal of vegetation and litter and the spread of exotic plant species, which can increase susceptibility of soil loss from wind and water erosion; and
- Increased fire frequency on rangelands dominated by the exotic annual grasses, cheatgrass, and medusahead; this increases the frequency with which soil is unprotected and susceptible to erosive events.

Livestock grazing effects that trend toward historical on Forest Service- and BLM-administered lands through implementation of Healthy Rangeland strategies and integrated restoration priorities suggest protection and improvements to soil productivity. Livestock grazing effects that trend toward historical the strongest, in Alternative S2, would provide higher benefits to soils than Alternative S3, followed by Alternative S1.

Over the next 100 years, livestock grazing effects that trend toward historical in the high restoration priority subbasins would occur primarily because of improvements in livestock management combined with forest and rangeland restoration activities. These changes would be more aggressively implemented in Alternative S2; therefore, the trend in livestock grazing effects toward historical would be slightly stronger for Alternative S2 than for Alternative S3. Although these trends in livstock grazing effects were not directly modeled for changes in soil functions and processes, these trends do correlate to long-term improvements in soil productivity.

Large Snags and Large Downed Wood

Large snags and large downed wood are used in this analysis to qualitatively evaluate the effects of the alternatives in providing long-term soil productivity. For soil productivity, large downed wood is defined as any woody residue larger than three inches in diameter. Excessive amounts of large downed wood can result in undesirable effects when consumed by wildfire. Unnaturally high concentrations of large downed wood can increase the burning duration and can result in severe adverse effects on soil properties. Desired volumes of coarse woody debris to maintain or restore preferred levels of organic matter for soil productivity vary and are based on research conducted on selected forest types within the Rocky Mountains (Graham et al. 1994). Management of snags and downed wood, both in the amount and size distribution that would be expected under historical conditions, can protect and restore soil productivity.

Large Snags

All alternatives would increase the amount of large snags above current levels on BLM- and Forest Service-administered lands. In the long term, Alternative S1 would nearly reach historical levels, while Alternatives S2 and S3 would result in slightly higher than historical amounts. The predicted increases in snags are likely the effects of protection for and restoration of late seral forests and snag requirements for management activities on Forest Service- and BLM-administered lands. All alternatives would result in projected snag densities that would provide favorable conditions for future recruitment of large downed wood, with a high likelihood of restoring and maintaining organic matter levels necessary for soil productivity and function.

Large Downed Wood

Overall, levels of large downed wood remain above historical amounts at 100 years for all alternatives. Amounts of large downed wood on Forest Service- and BLM-administered lands would decrease after 100 years for Alternatives S2 and S3 because of the increased use of prescribed fire. Amounts of large downed wood would continue to increase in Alternative S1.

For the riparian woodland vegetation group, all alternatives would increase the amount of large woody material, but only Alternatives S2 and S3 would return to historical levels. Alternative S2, better than Alternatives S3 and S1, would more likely contribute to long-term soil productivity by providing for recruitment of future large downed wood, while addressing the short-term concern by treating high fuel concentrations with prescribed fire.

Historical Range of Variability (HRV) Departure

Findings and comparisons of studies in forested and rangeland environments by Munn et al. (1978), Cannon and Nielsen (1984), and Hole and Nielsen (1970), conclude that forest and range landscapes that resemble conditions within historical ranges of variability (that is, they contain native plant communities in natural mosaic patterns and have relatively uninterrupted disturbance regimes) provide favorable conditions for soil functions and processes that contribute to long-term sustainability of soil productivity.

In addition, reduction in the spread of exotic vegetation (as defined in the *Landscape Dynamics* [Hann, Jones, Karl, et al. 1997] chapter of the *Assessment of Ecosystem Components* [Quigley and Arbelbide 1997]) is also expected to improve soil productivity and function. Observations from these studies further indicate that forests and rangelands with conditions outside the historical range of variability are most vulnerable to accelerated nutrient loss from management activities or wildfire.

Substantial changes in disturbance regimes—especially changes resulting from fire suppression, timber management practices, and livestock grazing over the past 100 years—have resulted in moderate to high departure of vegetation composition and structure and landscape mosaic patterns from historical ranges. Restoration activities that move forests and rangelands toward historical ranges of variability would provide favorable conditions for soil functions and processes that contribute to long-term soil productivity levels at the broad scale.

All alternatives would have a relatively small effect on slowing the movement toward moderate and high HRV departure on Forest Service- and BLM-administered lands over the next 100 years. In high restoration priority subbasins, localized effects of Alternatives S2 and S3 would tend to have lower overall increases in HRV departure for the long term when compared to Alternative S1. Alternative S2 would provide more protection and maintenance in soil productivity than either Alternative S3 or Alternative S1, because of the slight decrease in the rate of HRV departure.

Decreases in adverse road-related effects on soil productivity were qualitatively estimated based on the modeled outputs for road density trends.

Predicted Road Density Classes and Trends

Roading activities remove land from productivity and decrease soil functions that, depending on sensitive soil and watershed types, can result in long-lasting direct and indirect adverse effects in significant percentages of some watersheds. Adverse effects of roads were not directly assessed for effects on soil productivity. Decreases in adverse road-related effects were qualitatively estimated based on the modeled outputs for road density trends. Decreases in road density can correlate to reductions in surface erosion and mass wasting, which provide for the protection and restoration of long-term soil productivity. For all alternatives, analysis requirements are expected to decrease the amount of disturbance resulting from roads in the short- and long-term on Forest Service-administered lands. The rate of new construction would be slowed on Forest Service lands; the current, minimal amount of construction on BLM lands would likely be maintained.

Long-term reductions in road density are predicted to occur under all alternatives. For Alternative S1, road densities within the priority watersheds for bulltrout, steelhead trout, and chinook salmon are estimated to remain static or slightly decrease in the long term. The intensive restoration emphasis of Alternatives S2 and S3 would likely result in higher decreases in road densities than Alternative S1. The largest reductions in adverse road effects are mostly due to improved road maintenance and road closure and removal within the aquatic A2 network in the high restoration priority subbasins for Alternative S2. The downward trends in road densities and decreases in road-related disturbances would contribute to reductions in surface erosion and mass wasting, channel elongation, and gully development. As a result, decreases in adverse road effects with short- and long-term benefits to soil productivity are predicted to be highest for Alternative S2, followed by Alternative S3, then Alternative S1.

Conclusions

The quantitative evaluation that uses soil disturbance to describe effects on soil productivity indicates there would be no fundamental differences in effects among the alternatives. While the effects of the alternatives on soil productivity using a quantitative approach are inconclusive, long-term trends for soil productivity are more discernible using qualitative interpretations of outcomes for landscape variables that influence soil functions and processes.

When integrating the outcomes of the landscape variables, Alternative S2 would have the highest likelihood of improving landscape conditions for soil functions and processes that would sustain soil productivity for the long term. In the long term, Alternative S2 would provide: higher levels of fuels treatment to reduce uncharacteristic wildfire effects; stronger trends in livestock grazing effects toward historical, which connote improvements in rangeland conditions; higher emphasis on large snags for long-term recruitment and management of large downed wood; landscape restoration activities intended to slow the rate of HRV departure; and more emphasis on reducing road-related adverse effects.

Alternative S3 would be comparable to Alternative S2 for maintaining soil productivity levels, but lower levels of restoration activities combined with lower rates of hierarchical analysis preceding restoration activities decreases the likelihood for success. Alternative S1 primarily features continuation of traditional management approaches without an intensive restoration emphasis. Alternative S1 contains the least amount of direction among the three alternatives for providing landscape conditions that would maintain current levels of soil productivity over the long term.

Hydrology and Watershed Processes

Methodology: How Effects on Hydrology and Watershed Processes were Estimated

Detailed descriptions of the landscape and aquatic habitat variables are in Hemstrom et al. (1999) and Rieman et al. (1999), in the *Science Advisory Group Effects Analysis for the SDEIS Alternatives* (Quigley 1999).

The Science Advisory Group (SAG) did not directly model the effects on stream channel processes and water quantity, because quantitative predictions of outcomes for delivery and routing of water, sediment, and woody debris and their effects on streams and river systems are not possible at the broad scale. Use of finer scale outcomes that are not consistent with the landscape context of this Supplemental Draft EIS is not appropriate. Therefore, broad-scale outcomes were qualitatively estimated for effects on hydrologic function and watershed processes for BLM- and Forest Service-administered lands in the project area.

Rationale for Qualitative Interpretations of Modeling of Management Alternatives

Qualitative estimates of effects are inferred from predicted outcomes for certain landscape and aquatic variables that evaluated vegetation, disturbances, and varying activity levels with considerations to specific land allocations and analysis requirements. The rationale for using these outcomes is that they are key processes or activities that influence hydrologic systems and contribute to the protection and maintenance of ecological functions required for healthy watersheds.

The effects on hydrologic function and watershed processes are qualitatively described as they are influenced by:

- Trends for historical range of variability (HRV) departure, uncharacteristic wildfire events, livestock grazing effects, uncharacteristic soil disturbance, predicted road densities;
- The high restoration priority subbasin strategy;
- Protection of riparian areas and aquatic habitats through designation of riparian conservation areas (RCAs); and
- Requirements for and application of finer-scale analysis processes.

Effects of the Alternatives on Hydrology and Watershed Processes

Restoration activities that move forests and rangelands toward historical ranges of variability (HRV) will provide favorable conditions for hydrologic functions and watershed processes.

Historical Range of Variability (HRV) Departure

A key principle of the HRV concept is that restoration activities that move forests and rangelands toward historical ranges of variability (that is, they contain native plant communities in natural mosaic patterns and have relatively uninterrupted disturbance regimes) will provide favorable conditions for hydrologic functions and watershed processes.

All alternatives would have a relatively small effect on slowing the movement toward moderate and high HRV departure on Forest Service- and BLM-administered lands over the next 100 years. Within the high restoration priority subbasins, Alternatives S2 and S3

would tend to have lower overall increases in HRV departure for the long term when compared to Alternative S1. Based on these trends, the restoration emphasis in Alternative S2 combined with hierarchical analysis requirements would provide higher benefits to hydrologic functions and watershed processes than Alternative S3. It is likely that Alternative S1 would not decrease the rate of HRV departure; therefore, trends in hydrologic function and watershed processes are predicted to gradually worsen over the long term under that alternative.

Uncharacteristic Wildfire Events

Uncharacteristic effects from wildfire across large areas have long-lasting impacts on hydrologic functions and watershed processes. Increasing levels of severity and intensity that remove excessive amounts of plant and litter cover increase the potential for surface soil erosion and mass failures, with short-term increases in stream flows (Debano et al. 1996). The trends for uncharacteristic wildfire effects for the Supplemental Draft EIS alternatives were used to qualitatively estimate effects on hydrologic function and watershed processes.

Forest and rangeland fuels reduction activities are predicted to have similar effects for all alternatives in reducing the percentage of uncharacteristic wildfire. On Forest Service- and BLM-administered lands, uncharacteristic wildfire effects trend from very high and high to a low probability, with a general reduction of 16 percent.

However, within the high restoration priority subbasins in Alternatives S2 and S3, uncharacteristic wildfire effects would be reduced by 57 percent and 40 percent, respectively, over the long term. No similar pattern is observed with Alternative S1. With respect to effects from uncharacteristic wildfire, Alternative S2 would be slightly better than Alternative S3 in protecting and maintaining hydrologic function and watershed processes. The management direction for addressing uncharacteristic wildfire in Alternative S1 would do little to protect and maintain hydrologic function and watershed processes.

Livestock Grazing Effects

Livestock grazing effects (see definition in livestock grazing section) across large areas would result in loss of vegetation, litter cover, and root binding capability, and increased soil erosion and streambank failures. The trends for livestock grazing effects were used to qualitatively estimate effects on hydrologic function and watershed processes.

The *SAG Effects Analysis* suggests that livestock grazing effects would trend toward historical the strongest in Alternatives S2 and slightly less so in Alternative S3, and would lead to increased maintenance and restoration of hydrologic function and watershed processes. This is caused by implementation of Healthy Rangeland strategies and restoration priorities within these alternatives. Alternative S1 also would implement Healthy Rangeland strategies that would cause livestock grazing effects to trend toward historical, but the lack of restoration activities would not provide the same level of improvements to hydrologic function and watershed processes that would be achieved by Alternatives S2 and S3.

Soil Disturbance

Trends for soil disturbance are based on the likelihood of prescribed activities (timber harvest, thinning, "wildland fire use for resource benefit" [formerly called prescribed natural fire], and prescribed fire) to cause detrimental effects to surface soils (see soil productivity section). The prescribed activities and subsequent disturbances that create these effects can affect hydrologic functions and watershed processes by altering stream flows and sediment supply-transport regimes.

Most Forest Service- and BLM-administered land is projected to be in the very low and low soil disturbance categories for all alternatives over the long term. (See the Effects on Soil Functions and Processes section.) This trend indicates there would be very little difference among the alternatives; based on these outcomes, hydrologic function and watershed processes would likely be maintained for all alternatives over the next 100 years.

Predicted Road Densities and Trends

Road-related disturbances disrupt hydrologic function by modifying the surface and subsurface water flowing within a watershed. In addition to an increased potential for surface erosion and mass wasting, roads and roadside ditches increase the efficiency for the delivery of water, sediment, and other pollutants to nearby stream channels (Montgomery 1994). Trends in road densities and road-related adverse effects were used to estimate conditions for hydrologic function and watershed processes. For all alternatives the Forest Service national roads policy and associated analysis requirements are expected to decrease the amount of disturbance resulting from roads in the short- and long-term on Forest Service-administered lands. The rate of new construction would be slowed on National Forest System lands; the current, minimal amount of construction on BLM lands would likely be maintained.

Road density trends for Alternative S1 are estimated to remain static in the long term. Some road closure and removal is likely to occur within priority watersheds for bull trout, steelhead, and chinook salmon. The restoration emphasis of Alternatives S2 and S3 would result in higher decreases in road densities than Alternative S1. The largest reductions in adverse road effects would result from improved road maintenance and road closure and removal under Alternative S2. The downward trends for road densities and decreases in road-related disturbances would contribute to reductions in surface erosion and mass wasting, channel elongation, and gully development. As a result, decreases in adverse road effects with short- and long-term benefits to hydrologic function and watershed processes would be highest for Alternative S2, then Alternative S3 and Alternative S1, respectively.

High Restoration Priority Subbasins

Alternative S1 would continue PACFISH/INFISH direction and associated Biological Opinions (BOs), with outcomes emphasizing protection of riparian and aquatic systems. Alternative S1 management direction and activities would include some restoration of hydrologic function and watershed processes, but they would be accomplished under an aquatic theme, primarily in priority watersheds identified under PACFISH/INFISH and the BOs. Alternative S1 would not implement a broad-scale landscape restoration program. Focusing on the protection and restoration of hydrologic processes may provide immediate improvements to aquatic habitat quantity and quality; however, without considering an integrated, ecological strategy at the broad scale these efforts are assumed to have little bearing on larger scale watershed and ecosystem processes that create and maintain habitats through time (Reeves et al. 1995).

In Alternatives S2 and S3, aquatic and riparian systems would be fully integrated with watershed and upland processes to gain an understanding of the ecological interactions occurring at the broad scale. This would foster integration of multiple watershed components, including hydrologic function and watershed processes, to promote landscape restoration for long-term ecological health. Activities that have a landscape emphasis, such as those that would be implemented under the integrated restoration strategy, are more likely to be successful in protection, maintenance, and restoration of hydrologic processes at the watershed scale (Naiman et al. 1992). Furthermore, the ecosystem management direction in Alternatives S2 and S3 would more readily encourage implementation of adaptive management and analysis of cumulative effects than Alternative S1.

The high restoration priority subbasins identified in Alternatives S2 and S3 would provide a mechanism to prioritize activities that contribute to maintenance and restoration of integrated ecological processes at the broad scale. Higher levels of landscape restoration would occur in high restoration priority subbasins. Restoration opportunities would be identified and prioritized during Subbasin Review and Ecosystem Analysis at the Watershed Scale (EAWS), with the expectation of higher success in restoration and reductions in short-term risks. Alternatives S2 and S3 would use the Subbasin Review and EAWS for prioritization, with Alternative S2 using more context-setting hierarchical analysis than Alternative S3.

Although Alternative S1 does not incorporate the high restoration priority subbasins, activities are expected to be implemented using a restoration emphasis. However, these activities would be distributed over a much larger landscape, and effectiveness in meeting broad-scale ecological objectives would be questionable. Alternative S3 would pose greater short-term risk to hydrologic function and watershed processes than either Alternative S2 or the more protective and restrictive approach of Alternative S1. Consequently, the benefits to hydrologic function and watershed processes are predicted to be highest with Alternative S2, followed by Alternative S1, then Alternative S3.

Riparian Conservation Area Protection and Management

Intact and functioning riparian areas are critical components in the landscape that integrate aquatic systems with uplands, forming the basic ecological system (Lotspeich and Platts 1982, Naiman et al. 1992). All alternatives in the Supplemental Draft EIS have goals, objectives, and standards that would manage for the protection and restoration of riparian conservation areas (RCAs) on National Forest System and most BLM-administered lands in the project area. The ecological functions of riparian areas occur at varying distances depending on the range and character of riparian and wetland vegetation (Lee et al. 1997, FEMAT 1993). The extent of the areas under riparian consideration and emphasis varies by alternative (see Aquatics section). Key differences among the alternatives include elements that provide flexibility in RCA delineation criteria, which determine the amount of area within RCAs. However, these differences could generate local risks to ecological function of riparian and aquatic ecosystems.

Alternative S1 requires specific criteria for delineating RCAs with an emphasis on the protection of riparian areas. Alternatives S2 and S3 emphasize ecological conditions as the underlying criteria for managing RCAs to maintain riparian processes. Using broad-scale information, Alternative S2 would result in the largest area within RCAs, followed by Alternatives S1 and S3. Alternatives S2 and S3 have designated areas, based on hillslope steepness, that are intended to minimize sediment delivery into RCAs. In Alternative S2 this area applies to all RCAs; in Alternative S3 this criterion applies only to intermittent stream RCAs, while Alternative S1 does not have criteria for an influence area (see the RCA Delineation section in Chapter 3, and the Effects on Riparian Habitats section, later in this chapter).

Alternative S2 would maintain riparian ecological processes through time and would contribute most to protecting, maintaining, or restoring watershed processes and hydrologic function. Some uncertainty would exist with Alternatives S1 and S3 because of interim delineation criteria for intermittent streams and reduced emphasis on sediment delivery influence areas. These two alternatives may not provide for full protection of riparian ecological processes and, therefore, may not be as effective in maintaining watershed processes and hydrologic function as Alternative S2.

Hierarchical Analysis Requirements

The role of hierarchical analysis is to increase the likelihood of ecologically appropriate outcomes, in two ways: (1) by providing a context for management actions that are within the capabilities and limitations of a specific hydrologic unit, and (2) by serving as an effective mechanism for prioritizing actions and weighing multiple risks to specific resources within the ecosystem. Completing hierarchical analysis at the subbasin and watershed scales allows for appropriate identification and assessment of the ecological interactions that are integral components of healthy watersheds.

The requirements for Subbasin Review and Ecosystem Analysis at the Watershed Scale (EAWS) vary among the alternatives. For Alternative S1, the biological opinions on the land and resource management plans for chinook, sockeye, and steelhead (NMFS 1995, 1998) require one subbasin assessment and one EAWS be completed by each Forest Service and BLM unit per year within the portion of the basin encompassed by the biological opinions. In addition, Alternative S1 requires EAWS prior to project implementation for some activities within priority watersheds (as directed by existing biological opinions). These requirements contain limited mechanisms for directing hierarchical analyses in an ecological context that would appropriately examine watershed-scale processes and functions.

Alternatives S2 and S3 require hierarchical analysis to provide the context for watershed-scale processes and functions, for efficient and effective prioritization of base-level and restoration activities. Application of hierarchical analysis under Alternatives S2 and S3 would more adequately than Alternative S1 incorporate hydrologic function and watershed processes and restore watershed health using an integrated landscape approach. For Alternative S1 the uncertainty is related to the lack of ecological context-setting relationships from disconnected subbasin assessment-to-EAWS step-down analyses; that leads to less emphasis for integrated ecological outcomes associated with finer-scale planning. Alternative S2 would potentially have a higher rate and frequency of Subbasin Review and EAWS than Alternative S3, followed by Alternative S1. The reduced rate and frequency of context-setting analyses for Alternatives S3 and S1 may lead to less effective restoration activities than Alternative S2. Overall, the hierarchi-

cal analysis requirements in Alternative S2 would provide higher benefits to hydrologic function and watershed processes, followed by Alternative S3 and Alternative S1, respectively.

Conclusions

When blending the qualitative outcomes for processes and activities that influence hydrologic systems, Alternative S2 is most likely to generate landscape conditions that would contribute to the maintenance and restoration of hydrologic functions and watershed processes. Alternative S2 contains a more aggressive restoration approach by implementing higher amounts of prescribed activities designed to correct or minimize adverse effects resulting from wildfire, livestock grazing, and roads. In addition, a higher rate and frequency of context-setting hierarchical analyses and integration of riparian, aquatic, and upland restoration needs at the landscape scale are predicted to increase the effectiveness and success of the prescribed activities. Overall, these components in Alternative S2 are expected to best provide for restoration, maintenance, and protection of hydrologic function and processes for the long term.

Alternative S3 is predicted to have similar outcomes in terms of correcting or minimizing adverse effects. However, Alternative S3 would have reduced levels of restoration activities. Combined with lower rates of context-setting hierarchical analysis, which would lead to less emphasis on integration of landscape-scale processes, Alternative S3 would not be as effective as Alternative S2 in restoring or maintaining hydrologic functions and watershed processes.

Alternative S1 has very minimal requirements for context-setting hierarchical analysis. Compared to Alternatives S2 and S3, the emphasis of Alternative S1 is focused primarily on aquatic resources by providing higher levels of protection to current riparian and aquatic conditions. With little recognition of the need for restoration of integrated landscape processes, Alternative S1 would least adequately provide for short- and long-term protection and maintenance of hydrologic function and watershed processes at the broad scale.

Air Quality

Methodology: How Effects on Air Quality were Estimated

The general approach used in constructing this air quality impact effects analysis was to portray typical air quality impacts from various levels of prescribed fire and wildfire. The modeling effort used meteorological data that was representative of the prescribed fire and wildfire season. This was done since all states in the project area have implemented smoke management programs to manage the smoke from prescribed fires. Figure 4-4, later in this section, shows the area covered by the modeling domain.

The analysis assumed that prescribed fires are ignited at 11:00 am, which results in the release of the bulk of the emissions during the unstable daytime hours when vertical mixing is enhanced and the smoke plume is likely to be diluted relatively quickly. Some prescribed fires are active during the stable nighttime hours and have the potential to produce higher ground-level impacts due to lower plume heights and less favorable dispersion conditions.

It was also assumed that the size of the source area is equal to the acreage burned, which may tend to overestimate the local dilution of pollutants, particularly during the early portion of the fire. However, since populated areas are usually many miles from range and forest land prescribed burning, this underestimate at the early stages of prescribed fires should be minimal. Figures 4-5 and 4-6 show a scenario of a 16-fold increase of a prescribed fire program over the 1990 level and should compensate for some of the shortcomings of the modeling effort.

This analysis suggests that wildfire impacts are significantly greater in magnitude than prescribed burning impacts. Although the relative frequency of such impacts was not modeled, it can be assumed the frequency of impacts will follow the episodic nature of wildfire or prescribed fire.

The projection of effects on air quality was based on additional assumptions made by the EIS Team:

- Wildfires and prescribed fires do not occur at regular intervals throughout the year, but rather occur in patterns of varying intervals between fires or groups of fire events (episodes).
- For wildfires, a combination of weather conditions and ignition sources (usually lightning) need to occur. When weather associated with intense fire behavior and multiple ignitions occur, the result can be multiple large fires, which account for most of the acres burned by wildfire.
- In the case of management-ignited prescribed fire, weather is a primary factor in determining if an area can be burned under conditions that will meet the objectives of the fire and management of the smoke. When weather conditions become favorable for prescribed burning, the result is usually an episode in which large amounts of prescribed fire are occurring simultaneously but are managed under the guidance of state smoke management forecasters.
- All prescribed burning will be done under the auspices of state-operated or sanctioned smoke management plans which are part of State Implementation Plans (SIP) for the Clean Air Act. If a state currently does not have a smoke management plan that covers both range and forestland prescribed burning, efforts will be made to work with the state to develop one.
- When appropriate, near real time monitoring of wildland fire smoke will be provided to smoke management forecasters by the federal land management agencies to help meet the objectives of the smoke management plan.

Models (CALPUFF, CALMET [Scire et al. 1995, Scire and Tino 1996], and Emissions Production Model (EPM [Sandberg and Peterson 1985]) were used to assess the impacts of wildfire and prescribed fire smoke on air quality within the project area. Estimates were made for the effects on health standards and visibility as a result of particulate matter emitted from wildfires and from a range of prescribed fires that would result from the strategies under consideration for the EIS.

The emission rates for understory burns were estimated with the Emissions Production Model (EPM). This model was developed by the Forest Service to predict particulate emissions from pile and broadcast burning of harvest residues, not from understory burning. While the application of EPM to understory burning introduces additional uncertainty to the analysis, experts believe the Emissions Production Model is the best tool available for estimating emissions from understory burning.

Wildfires and prescribed fires were compared because aggressive fuel treatment can significantly reduce the likelihood of large damaging wildfires, and because prescribed fire is proposed as a major fuel treatment alternative and restoration tool in the project area. The belief that fuel treatment can reduce the impacts of wildfires has been common among fire managers for years, has been witnessed in the field, and was

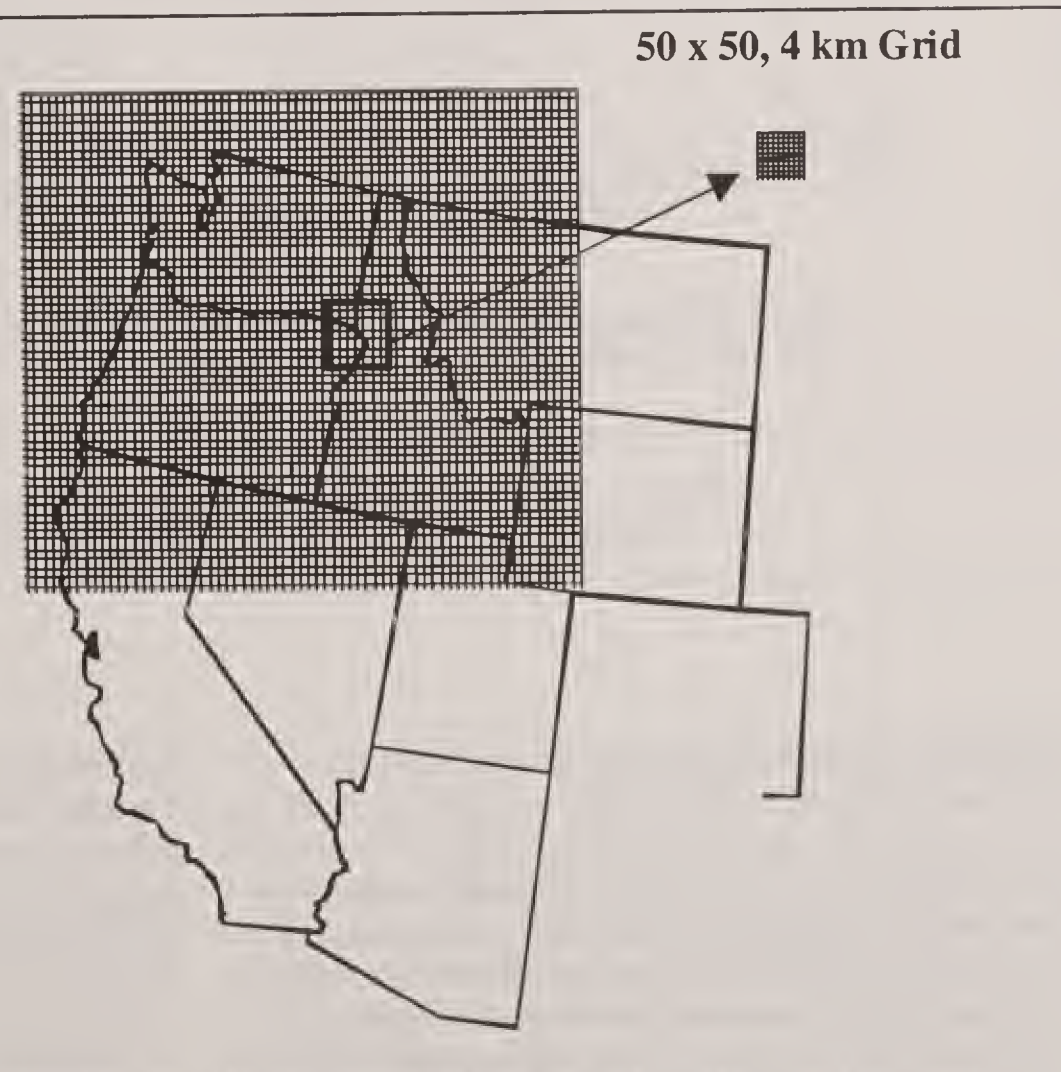


Figure 4-4. The Regional Columbia River Basin Air Quality Modeling Domain. The grid cell size is 20 km. The grid of 65 x 53 cells covers 1,300 km x 1,600 km. The 10 km x 10 km grid was used in the fine-scale modeling. Source: Scire and Tino 1996.

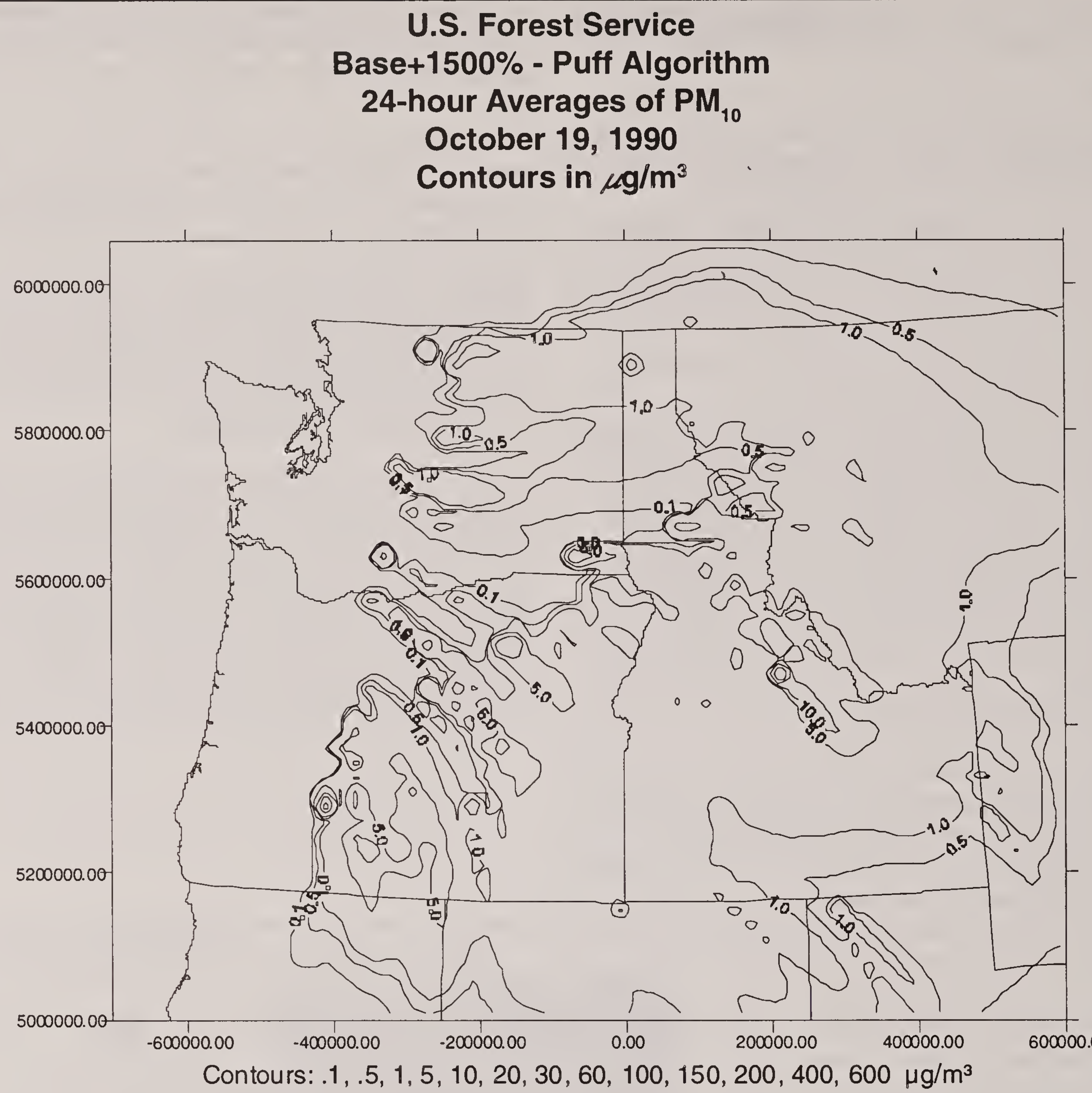


Figure 4-5. Prescribed Fire PM_{10} Emissions After Six Days of Continuous Burning Using 20 Km Grid. This scenario is based on levels 16 times the 1990 level (contours in $\mu G/m^3$).

initially demonstrated by a study completed in northeast Oregon (Schaaf 1996).

Modeling of smoke emission dispersion was dependent on a meterological database of gridded hourly wind fields for 1990 developed by the U.S. EPA (Scire and Tino 1996). In order to run the models, four meteorological databases were constructed by integrating terrain with actual atmospheric conditions experienced during four separate time periods in 1990. These time periods represented typical weather and smoke dispersion conditions for two spring periods and one fall period for prescribed fire and one summer period for wildfires. The databases included wind fields and other meteorological information that affect smoke dispersion. The time periods, or modeling episodes, were as follows:

- An early spring episode (March 27 through 31) representing typical prescribed burning conditions in the southern part of the project area below the 46th parallel.

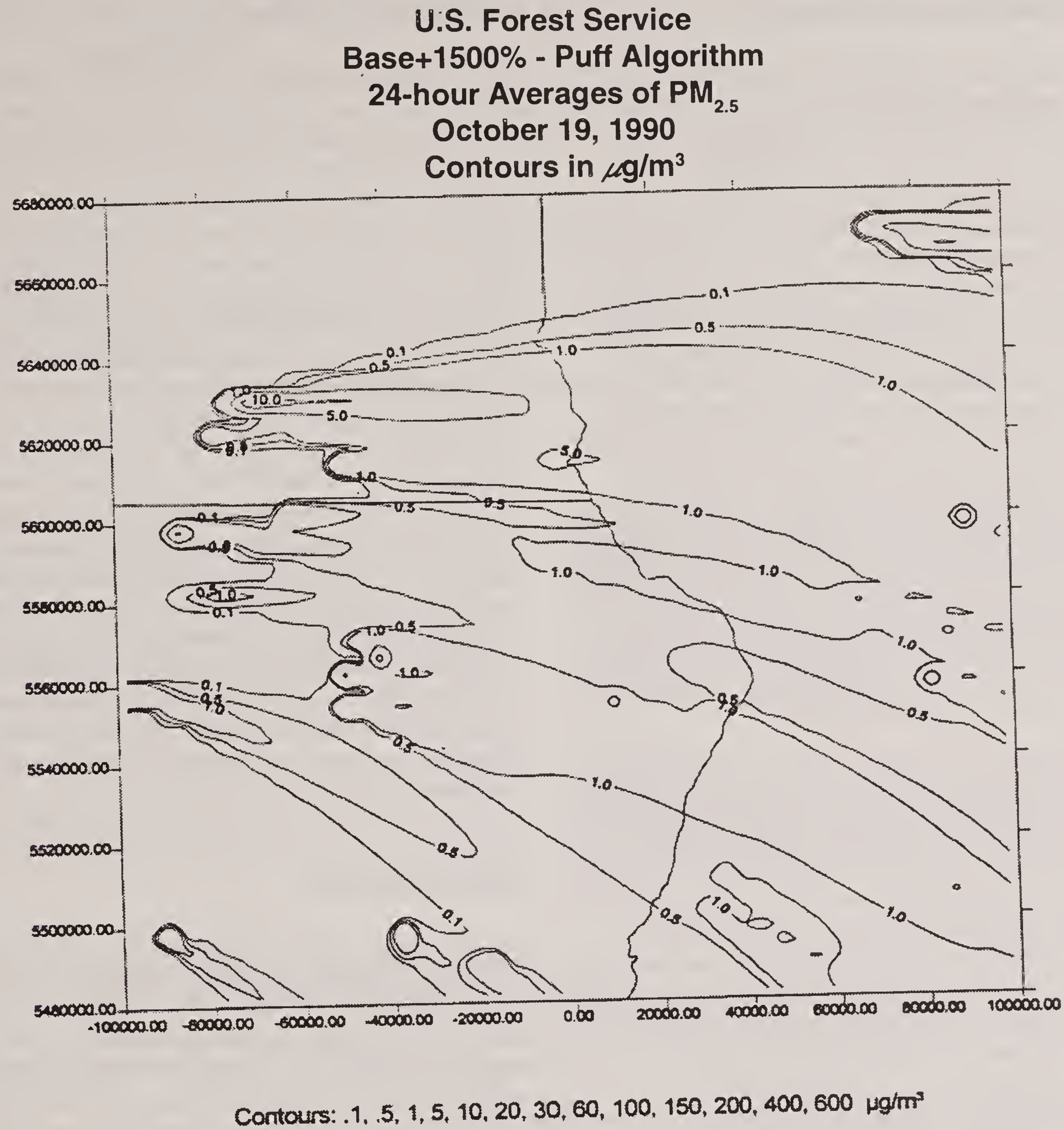


Figure 4-6. Prescribed Fire $PM_{2.5}$ Emissions After Six Days of Continuous Burning Using a 4 Km Grid. This scenario is based on levels 16 times the 1990 level (contours in $\mu G/m^3$). Source: Scire and Tino 1996.

- A late spring episode (May 4 through 11) representing prescribed burning conditions in the northern part of the project area above the 46th parallel.
- A summer episode (August 6 through 13) during which a large number of wildfire acres burned.
- A fall episode (October 14 through 19) representing prescribed burning conditions for both the northern and southern parts of the project area.

The sum of the acres burned during the spring and fall modeling episodes represents about 12 percent of the annual burning being proposed in the project area for Alternatives S2 and S3. To make estimates of annual emissions from these episodes, emissions were expanded arithmetically to represent the total acres being planned for burning under the three management strategies.

Prescribed Fire Scenarios

For the analysis of spring and fall prescribed fire smoke, different emission scenarios were evaluated — a base level (Alternative S1) representing current prescribed fire activities, base +300 percent representing the acres being burned for Alternative S2, and base +200 percent representing the acres being burned for Alternative S3. The estimate of the baseline level of prescribed fire was made from a count of all the management-ignited prescribed fires in 1990 from Forest Service and BLM units in the project area. Although accurate locations and vegetation types burned were generally unavailable, previous work (Peterson and Ward 1992) estimated the proportion of all prescribed fires that occurred in each of four general fuel types (mixed conifer, ponderosa pine, shrub/grass, and grass) in spring and fall. The base prescribed fires were allocated to these four fuel types according to the proportions estimated by Peterson and Ward (1992) and shown in Table 4-2. Using Geographic Information System (GIS), fires were placed on the landscape by randomly selecting locations of the assigned fuel type.

The efficiency of combustion and hence the amount of smoke produced is characteristically different for pile burns, underburns, and broadcast burns. Every prescribed fire was therefore coded to one of these three fire types according to the proportion of each of these fire types that typically occurs. The fuel loading (volume of downed woody material by size classes, litter, and duff) used for the four fuel types represented average loadings. Sizes of burns varied based on data collected for each of the three types of burns.

The base level of prescribed fire included the amount and distribution of fire among fire types and cover types that represent peak levels of weekly prescribed fire activity during early spring, late spring, and fall of 1990. The base scenarios that characterize each period include the number of burned units, unit sizes, fuel types, and fire types (underburns, broadcast burns, and pile burns). In each of the two base spring scenarios, 1,586 prescribed fire acres were modeled; for the base fall prescribed burning period, 13,883 acres were modeled. Total prescribed fires modeled for the base level was (2 x 1,586 + 13,883) 17,055 acres. These acreages were increased proportionally to represent the acres being planned for Alternatives S2 and S3 (Table 4-6, later in this section).

Wildfire Scenarios

For the summer weather period, an actual wildfire scenario was used, based on an estimate of daily acreage and types of fuels burned by wildfires from August 8 to August 13, 1990. Data on location, size, and acres burned per day for fires on all state and federally protected lands were obtained from records kept at the National Interagency Coordination Center (daily "incident management situation reports" [Boise, Idaho]). Only those wildfires 100 acres and larger were used in this analysis because these larger fires made up the vast majority of the wildfire acres burned. Based on information about location and plant community where the wildfires occurred, each fire was classified as burning in one of the four fuel types (mixed conifer, ponderosa pine, shrub/grass, and grass). The origin of the actual fire was used to place the fire for modeling purposes, and acres burned per day were used in the emission calculations. Cumulative impacts of emissions were modeled for eight days of meteorological data. The estimated emissions from the 1990 wildfires were then proportionally applied to the estimated wildfires acres burned (from CRBSUM) shown in Table 4-3, which are based on a 10-year administrative average (1988–1997).

Use of Models

The modeling domain (Figure 4-4) covers an area that is approximately 800 miles by 660 miles.

This area includes all of the project area and an appropriate buffer zone around the edges of the area of interest to allow the consideration of recirculating wind flows and boundary effects. The area was divided into 3,445 cells that were 154 square miles each (or 400 square kilometers [km] with 20 square kilometer grids). Particulate matter (PM) concentrations and changes in visibility were estimated for each of the 20 square kilometer grid cells.

To help assess the impacts on air quality from smoke at a more local level, a scenario was run using a fine-scale domain of 50 x 50 4-km grid cells covering a 200 km x 200 km area (Figure 4-4), which was a 10 x 10 grid cell subset of the 20 km grid cells used in regional domain. This fine-scale domain covered northeastern Oregon, southeastern Washington, and west central Idaho.

Table 4-2. Percentage of Prescribed Fires by Fuel Type[1] Used in the Air Quality Analysis.

Fuel Type	Spring Prescribed Fire	Fall Prescribed Fire
	Percent	
Grass	13	1
Shrub	19	8
Ponderosa Pine	5	7
Mixed Conifer	62	84

[1] This table shows the estimated percentage of prescribed fire for four general vegetation types for the project area.

Source: Scire and Tino 1996.

Particulate matter emissions and heat release rates were calculated for each prescribed fire and wildfire, using the Emissions Production Model (Sandberg and Peterson 1985). CALPUFF, an advanced Lagrangian puff model (Scire et al. 1995), was used to produce estimates of ambient concentrations of particulate matter smaller than 10 microns (PM_{10}), estimates of particulate matter less than 2.5 microns ($PM_{2.5}$), and estimates of related visibility impacts. The concentration estimates were averaged over 24 hours to correspond to the National Ambient Air Quality Standards (NAAQS) daily averaging period and the prevention of Significant Deterioration increments for PM_{10} developed under the Clean Air Act. The 24-hour NAAQS for PM_{10} is 150 micrograms per cubic meter ($\mu g/m^3$), and for $PM_{2.5}$ it is 65 $\mu g/m^3$. When modeling was done for the EIS, the $PM_{2.5}$ NAAQS had not been established but was anticipated, and a conservative estimate of 60 $\mu g/m^3$ was used.

To evaluate the air quality impacts of prescribed burning and wildfire emissions, threshold values of 150 $\mu g/m^3$ and 60 $\mu g/m^3$ were used, not to serve as an assessment of compliance with the NAAQS, but to

Table 4-3. Estimated Acres[1] Burned from Wildfires, by Resource Advisory Council/ Provincial Advisory Committee (RAC/PAC) and Alternative.

RAC/PAC	Alternative S1 Year 10	Alternative S1 Year 100	Alternative S2 Year 10	Alternative S2 Year 100	Alternative S3 Year 10	Alternative S3 Year 100
Butte RAC	33,588	26,147	35,107	17,935	36,702	19,480
Deschutes PAC	8,465	9,284	8,297	5,652	9,112	6,803
Eastern Washington Cascades PAC	4,174	4,929	2,996	3,261	3,133	3,365
Eastern Washington RAC	7,873	5,108	8,909	4,628	9,276	4,747
John Day-Snake RAC	76,757	71,463	58,639	48,430	60,577	47,970
Klamath PAC	3,627	4,608	3,424	4,288	3,293	4,202
Lower Snake River RAC	112,863	98,091	105,655	81,164	120,460	87,519
Southeastern Oregon RAC	58,105	49,218	61,145	41,823	60,591	41,790
Upper Columbia/Salmon-Clearwater RAC R1	21,757	17,954	22,007	13,611	24,181	15,209
Upper Columbia/Salmon-Clearwater RAC R4	111,456	118,872	108,757	97,847	107,012	94,093
Upper Snake River RAC	88,312	74,905	89,118	62,950	83,703	55,350
Yakima PAC	226	185	228	172	251	177
Totals	527,203	480,764	504,282	381,761	518,291	380,705
Percent Change from Current	16%	6%	11%	-16%	14%	-16%

Abbreviations used in this table:
R1 = Forest Service Northern Region
R4 = Forest Service Intermountain Region

[1] These numbers are acres of Forest Service- and BLM-administered lands in the portion of the RAC or PAC area in the project area.

Source: J. A. K. Snell, personal communication, 1999.

provide an indication of whether or not the forest and rangeland burning emissions by themselves may be expected to lead to widespread, regional-scale exceedances of the NAAQS.

From a regulatory perspective, an evaluation of ambient air and compliance with the NAAQS is based on the cumulative impacts from all sources of air pollution on ambient air. Since this study was done at a 20 km resolution, and ambient air (that is, background) concentrations were not available for the project area (monitored or modeled), this analysis did not include the cumulative impacts from other sources of particulate matter pollution. However, to assist readers, Figures 4-5 and 4-6 are included to help determine whether emissions from the prescribed fire scenarios would potentially cause an area to exceed NAAQS.

Using a 20 km cell grid, Figure 4-5 shows the impact on air quality for PM_{10} on the sixth day of continuous burning using the meteorological data from October 19, 1990. To be conservative, and to compensate for some of the uncertainties in the modeling process, Figure 4-5 shows a scenario that represents 16 times the acres burned during the 1990 fall prescribed fire modeling period. Caution must be used in interpreting these data, since the background level still must be added. Sources for most background particulates are blowing dust and winter woodstove smoke, which generally occur during a time when little, if any, prescribed fire activity can be expected from any of the management strategies. Even at this high level of prescribed burning, however, the amount of $PM_{2.5}$ that the reader must add to the background is still relatively small. Although only October 19, 1990 is shown, the modeling included prescribed fires that burned from October 14 through October 19, 1990. This was done to make estimates of the cumulative impacts of smoke from prescribed fires burning across multiple days.

Using the 4 km cell fine-scale domain, Figure 4-6 shows the impact on air quality for $PM_{2.5}$ on the sixth day of continuous burning using the meteorological data from October 19, 1990. The figure shows a scenario that increases the acres burned by 16 times over the base level during the fall burning season where the competition for the airshed is the highest. Even at this high level of prescribed burning, the amount of $PM_{2.5}$ that the reader must add to the background is still relatively small.

Tables for each prescribed fire and wildfire scenario depict the number of grid cells that exceed the 150 $\mu g/m^3$ and 60 $\mu g/m^3$ thresholds set for PM_{10} and $PM_{2.5}$ respectively (Tables 4-4 and 4-5). There were no exceedances of these thresholds for the prescribed fire scenarios; however, if background had been added there may have been additional exceedances. There were significant exceedances for the wildfire scenarios. The wildfire scenario is based on the actual location and acres burned from August 6 through 13, 1990. The results shown in the tables show that 190 and 443 grid cells exceeded the PM_{10} and $PM_{2.5}$ thresholds respectively.

Effects on visibility from smoke production by the various scenarios were assessed using a haziness index, expressed in deciviews (Pitchford and Malm 1994). A change in one deciview corresponds to an approximate 10 percent change in the light extinction coefficient, which is considered a small but perceptible decrease in visibility. When considering the impacts of smoke production on visibility, it should be noted that in areas where the air is clean and visibility is good, a relatively small amount of smoke can be perceptible. If an area has relatively poor visibility, more smoke is required to create a perceptible change.

The air quality dispersion model used in this analysis, CALPUFF, was recommended for regional-scale analysis by the Interagency Work Group on Air Quality Modeling. This Interagency Work Group on Air Quality Modeling is composed of representatives from the Environmental Protection Agency, the Forest Service, the National Park Service, and the U.S. Fish and Wildlife Service. Composed of air modeling experts, the Interagency Work Group was formed to review, identify, and recommend candidate air quality simulation modeling techniques that can be used to estimate pollutant concentrations over long transport distances.

CALPUFF was selected for its capabilities to simulate temporally and spatially vary emissions and meteorological conditions, features that make it superior to more commonly used regulatory models. With these features, CALPUFF has the potential to more realistically simulate complex wind flows associated with the mountainous terrain of the project area.

Limitations of Modeling

To understand the significance and proper application of the results of this modeling analysis, it is essential to note the limitations of the analysis conducted. CALPUFF's sensitivity and performance have not been evaluated, and the accuracy and potential biases of the model relative to its application to forestry burning sources are unknown. Because no thorough

Table 4-4. PM_{10} Particulate Emissions, Wildfire Scenario, August 6–13, 1990.

	Number of Grid Cells with PM_{10} Concentrations Above 150 g/m³								
Acres Burned	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Total[1]
171,180	0	0	2	5	25	49	28	1	110

Abbreviations used in this table:
PM_{10} - Particulate matter smaller than 10 microns.
g/m³ - Micrograms per cubic meter.

[1] If background had been added, more grid cells might have exceeded the 150 g/m³ threshold

Source: Scire and Tino (1996).

model evaluation has been conducted, the results from this modeling exercise are expected to be less reliable than those developed in typical regulatory evaluations of National Ambient Air Quality Standards attainment. Care should be taken when comparing these modeling results with those conducted for evaluating non-attainment areas. Standard particulate matter NAAQS modeling for non-attainment areas uses worst-case assumptions to provide certainty that health-based standards will not be violated.

This modeling analysis evaluated impacts of wildfires and management-ignited prescribed fires on a regional scale. Use of a coarse 20 kilometer (km) receptor grid was required to provide coverage over the entire project area. While this regional approach is appropriate for a programmatic EIS, it cannot be used to assess impacts of burning on causing exceedances of the NAAQS at any individual location.

Furthermore, while the fine-scale domain used to help assess the impacts on air quality from smoke at a more local level (described earlier, see Figure 4-2) is appropriate for a programmatic EIS, this modeling method cannot be used to assess whether the effects of burning would cause the NAAQS to be exceeded at any individual location.

The quality of ambient air is defined by the cumulative effect from all sources; because neither monitored nor modeled data at the 20 km or 4 km resolution were available for the analysis, ambient air concentrations need to be added to the results of this analysis. For example, the impacts from stationary sources such as factories and pulp mills, and major area sources such as automobiles, should be added. Estimates of cumulative impacts must be made by adding the concentrations shown in Figures 4-5 and 4-6 to the local concentrations of concern. This will give only a very coarse estimate of PM_{10} or $PM_{2.5}$ concentrations.

Table 4-5. $PM_{2.5}$ Particulate Emissions, Widlfire Scenario, August 6–13, 1990.

	Number of Grid Cells with $PM_{2.5}$ Concentrations Above 60 g/m³								
Acres Burned	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Total[1]
171,180	0	0	5	41	65	130	157	45	443

Abbreviations used in this table:
$PM_{2.5}$ - Particulate matter smaller than 2.5 microns.
g/m³ - Micrograms per cubic meter.

[1] If background had been added, more grid cells might have exceeded the 60 g/m³ threshold

Source: Scire and Tino (1996).

The question of NAAQS attainment at the 20 km or 4 km resolution is not very useful, because NAAQS attainment must be addressed at the local level when more site-specific information is available.

Emissions produced from smoldering fuels were included in the modeling. The emission factors (that is, the amount of emissions produced per unit of fuel consumed per unit of time) for smoldering are not as precise as those used for other phases of burning. Emission factors for smoldering are currently being refined by research and were not available for use in this Supplemental Draft EIS.

Effects of the Alternatives on Air Quality

Prescribed and Wildland Fire

Prescribed fire is the only planned management action that would affect air quality at the broad scale.

Prescribed fire is the only planned management action that would affect air quality at the broad scale. When wildfires occur the magnitude of visibility reduction would be substantially more than during prescribed burning. However, prescribed burning would affect air quality more frequently. In the long term, wildfires are expected to decrease in frequency for both Alternatives S2 and S3. Results of the analysis of prescribed fire are compared to the effects of wildfire on air quality. The effects of the alternatives on two different aspects of air quality were assessed: effects on the amount of particulate matter released (a component of the National Ambient Air Quality Standards), and effects on visibility.

Table 4-6 shows the expected *annual acres being burned* for each alternative by RAC/PAC area.

Tables 4-7 and 4-8 show the expected *annual emissions for PM_{10} and $PM_{2.5}$* from prescribed fire by RAC/PACs respectively for each alternative. The acres shown in Table 4-6 increase at a faster rate than the emissions shown in Tables 4-6 and 4-7 because of two factors: (1) the average size of the burns would increase from 27 acres for Alternative S1 to 137 acres for Alternatives S2 and S3, and (2) the amount of fuel consumed per acres would be less per acre for Alternatives S2 and S3 compared to Alternative S1 because of a change to a more mosaic pattern of fire (patches of burned and unburned areas) in the unit under the action alternatives compared to Alternative S1 where nearly all the acres within the unit were burned. Figures 4-7 and 4-8 show the average annual $PM_{2.5}$ emissions from prescribed fire and wildfire, re-spectively, by RAC/PAC area for each alternative.

The modeling conducted for this analysis was intended to compare the regional impacts of different land management practices over millions of acres of land. The size of the area of concern and the scope of the programmatic changes discussed in this EIS dictated that a large modeling domain and a relatively coarse grid of receptors be used. Because many air quality impacts, such as compliance with the NAAQS, are chiefly determined by localized conditions, a modeling analysis used to evaluate programmatic changes cannot really answer whether NAAQS would be attained or violated. At best, analysis at this level can give a general assessment of relative impacts from prescribed burning and wildfires, by management strategy.

None of the 3,445 20 km grid cells in the modeling domain exceeded threshold values (150 Fg/m^3) for 24-hour averages of PM_{10} concentrations in any of the prescribed fire scenarios. None of the prescribed fire scenarios exceeded the threshold of 60 Fg/m^3 for $PM_{2.5}$. However, for the wildfire scenario, 110 and 443 of the 20 km grids exceeded the thresholds of PM_{10} and $PM_{2.5}$ respectively (see Tables 4-4 and 4-5, earlier in this section). However, if background concentrations could have been added, the results may have varied.

The predicted concentrations of particulate matter for the prescribed fire scenarios are substantially lower than the wildfire scenarios for several reasons:
(1) higher fuel moisture levels during management-ignited prescribed fires compared to wildfires generally result in less fuel consumed per acre of prescribed fire than per acre of wildfire; (2) smoke dispersion conditions (determined by state smoke management forecasters) during the spring and fall prescribed burn episodes are better; and (3) prescribed fires are dispersed across the landscape spatially and temporally, rather than being concentrated in a few locations. Although a compensating factor for large wildfires is

Table 4-6. Acres of Prescribed Fire Activity,[1] by Resource Advisory Council/Provincial Advisory Committee (RAC/PAC) and Alternative.

RAC/PAC	Alternative S1 Year 10	Alternative S1 Year 100	Alternative S2 Year 10	Alternative S2 Year 100	Alternative S3 Year 10	Alternative S3 Year 100
Butte RAC	22,514	16,598	78,250	64,185	74,615	59,829
Deschutes PAC	18,235	13,568	27,852	26,518	28,147	27,237
Eastern Washington Cascades PAC	571	539	5,099	8,551	3,892	6,164
Eastern Washington RAC	1,959	2,128	12,084	9,356	9,614	7,318
John Day-Snake RAC	34,806	34,112	170,826	168,428	129,428	130,472
Klamath PAC	9,803	7,394	15,149	19,807	13,036	16,552
Lower Snake River RAC	3,151	2,849	9,474	8,568	4,089	4,230
Southeastern Oregon RAC	25,660	23,782	109,996	134,376	64,191	74,000
Upper Columbia/Salmon-Clearwater RAC R1	10,931	10,358	49,092	39,568	34,121	27,516
Upper Columbia/Salmon-Clearwater RAC R4	17,244	12,358	38,866	33,753	33,997	26,660
Upper Snake River RAC	2,741	2,221	6,338	4,823	6,742	5,232
Yakima PAC	5	4	22	24	17	18
Totals	147,619	125,910	523,049	517,956	401,889	385,227
Percent Change from Current	2%	-13%	260%	257%	177%	165%

Abbreviations used in this table:
R1 = Forest Service Northern Region
R4 = Forest Service Intermountain Region

[1] Net annual smoke-producing acres (Forest Service- and BLM-administered lands in the portion of the RAC or PAC area in the project area) from prescribed fire and "wildland fire use for resource benefit." These figures estimate net smoke-producing acres by first subtracting out the mechanical fuel reduction acreage from the acres of prescribed fire and fuels management (landscape variable PRS) and second by applying a reduction factor to the remaining total acres treated with prescribed fire to account for actual acres burned.

Source: J. A. K. Snell, personal communication, 1999.

Table 4-7. Expected Annual PM_{10} Emissions from Prescribed Fire Activity,[1] by Alternative and Resource Advisory Council/Provincial Advisory Committee (RAC/PAC).

Average Annual PM_{10} Emissions (Tons) for Prescribed Fire and "Wildland Fire Use for Resource Benefit" Acres Burned[2]

RAC/PAC	Alternative S1 Year 10	Alternative S1 Year 100	Alternative S2 Year 10	Alternative S2 Year 100	Alternative S3 Year 10	Alternative S3 Year 100
Butte RAC	4,203	3,098	8,192	6,720	7,908	6,341
Deschutes PAC	3,404	2,533	2,916	2,776	2,983	2,887
Eastern Washington-Cascades PAC	107	101	534	895	413	653
Eastern Washington RAC	366	397	1,265	980	1,019	776
John Day-Snake RAC	6,498	6,368	17,884	17,633	13,717	13,828
Klamath PAC	1,830	1,380	1,586	2,074	1,382	1,754
Lower Snake River RAC	588	532	992	897	433	448
Southeastern Oregon RAC	4,790	4,440	11,516	14,068	6,803	7,843
Upper Columbia/Salmon-Clearwater RAC R1	2,041	1,934	5,140	4,142	3,616	2,916
Upper Columbia/Salmon-Clearwater RAC R4	3,219	2,307	4,069	3,534	3,603	2,825
Upper Snake River RAC	512	415	664	505	715	555
Yakima PAC	1	1	2	3	2	2
Totals	27,558	23,505	54,758	54,225	42,594	40,828

Abbreviations used in this table:
PM_{10} - Particulate matter smaller than 10 microns.

[1] These numbers are acres of Forest Service- and BLM-administered lands in the portion of the RAC or PAC area in the project area.
[2] "Wildland fire use for resource benefit" was previously called prescribed natural fire.

Source: J. A. K. Snell, personal communication, 1999.

Table 4-8. Expected Annual $PM_{2.5}$ Emissions from Prescribed Fire Activity,[1] by Alternative and Resource Advisory Council/Provincial Advisory Committee (RAC/PAC).

	Average Annual $PM_{2.5}$ Emissions (Tons) for Prescribed Fire and "Wildland Fire Use for Resource Benefit" Acres Burned[2]					
	Alternative S1		Alternative S2		Alternative S3	
RAC/PAC	Year 10	Year 100	Year 10	Year 100	Year 10	Year 100
Butte RAC	3,611	2,662	7,147	5,863	6,901	5,533
Deschutes PAC	2,925	2,176	2,544	2,422	2,603	2,519
Eastern Washington-Cascades PAC	92	86	466	781	360	570
Eastern Washington RAC	314	341	1,104	855	889	677
John Day-Snake RAC	5,583	5,471	15,603	15,384	11,970	12,067
Klamath PAC	1,572	1,186	1,384	1,809	1,206	1,531
Lower Snake River RAC	505	457	865	783	378	391
Southeastern Oregon RAC	4,116	3,814	10,047	12,274	5,937	6,844
Upper Columbia/Salmon-Clearwater RAC R1	1,753	1,661	4,484	3,614	3,156	2,545
Upper Columbia/Salmon-Clearwater RAC R4	2,766	1,982	3,550	3,083	3,144	2,466
Upper Snake River RAC	440	356	579	440	624	484
Yakima PAC	1	1	2	2	2	2
Totals	23,677	20,195	47,775	47,310	37,169	35,628

Abbreviations used in this table:
$PM_{2.5}$ - Particulate matter smaller than 2.5 microns.
R1 = Forest Service Northern Region
R4 = Forest Service Intermountain Region

[1] These numbers are acres of Forest Service- and BLM-administered lands in the portion of the RAC or PAC area in the project area.
[2] "Wildland fire use for resource benefit" was previously called prescribed natural fire.

Source: J. A. K. Snell, personal communication, 1999.

the larger buoyancy and potentially higher plume rise compared to the smaller prescribed fire plumes, the wildfire plumes eventually mix down to the ground and result in higher ground-level concentrations of particulate matter.

Figures 4-9 and 4-10 show by alternative the expected annual PM_{10} and $PM_{2.5}$ emissions for both prescribed fire and wildfire.

Criteria Pollutants

Ozone and carbon monoxide are criteria pollutants also produced by wildland fire. Ozone is a byproduct of prescribed burning, but these fires are generally spatially and temporally dispersed, so potential ozone exposures from prescribed fire are infrequent (Sandberg and Dost 1990). Carbon monoxide is rapidly diluted at short distances from a prescribed burn and poses little or no risk to community health (Sandberg and Dost 1990). Other non-criteria, but potentially toxic, pollutants are emitted by prescribed burning.

Effects of pollutants from sources off public lands were evaluated based on: the review in the *Landscape Dynamics* chapter (Hann, Jones, Karl, et al. 1997) of the *Assessment of Ecosystem Components* (Quigley and Arbelbide 1997); correlation with landscape health; and emphasis on monitoring and prediction. In particular, management strategies that would provide management emphasis on a diversity of habitats and species that would be less susceptible as a biotic community to air pollutant effects were given higher ratings.

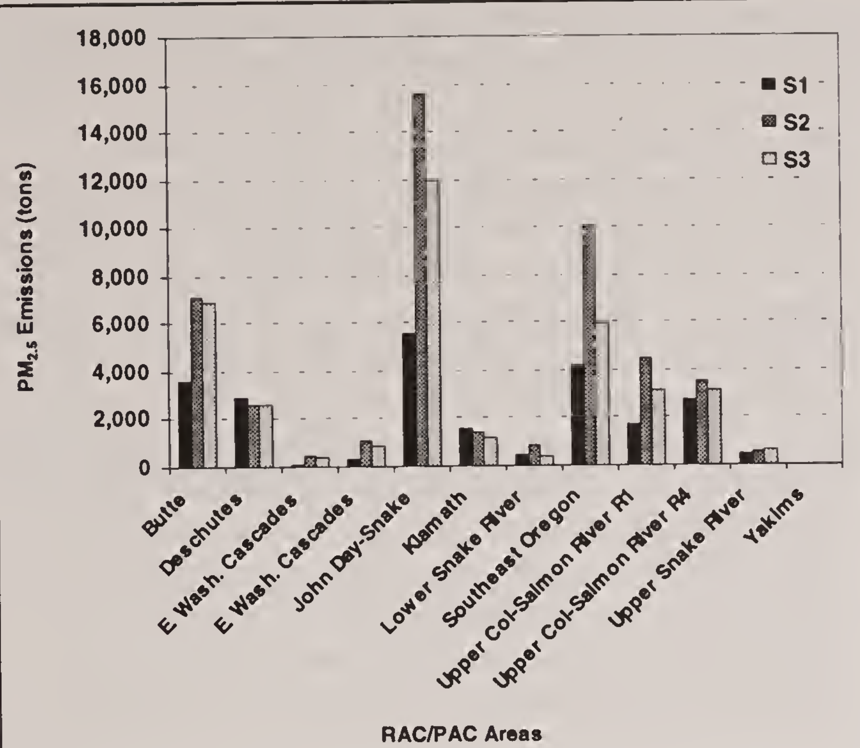


Figure 4-7. Average Annual $PM_{2.5}$ Emissions (Tons) Expected From Prescribed Fire, by RAC/PAC and Alternative. Source: J.A.K. Snell, personal communication,

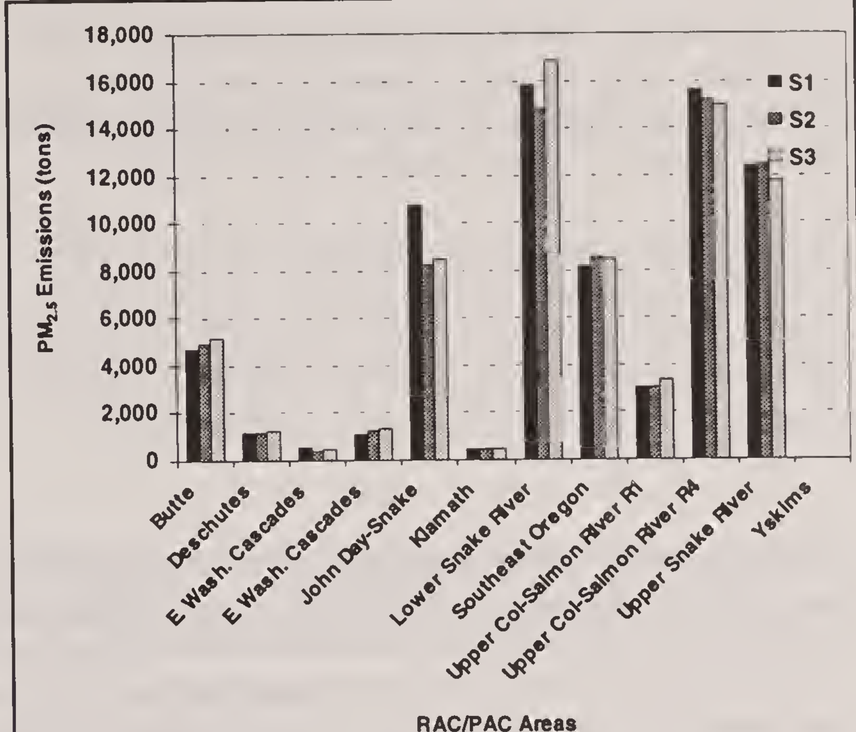


Figure 4-8. Average Annual $PM_{2.5}$ Emissions (Tons) Expected From Wildfire, by RAC/PAC and Alternative.

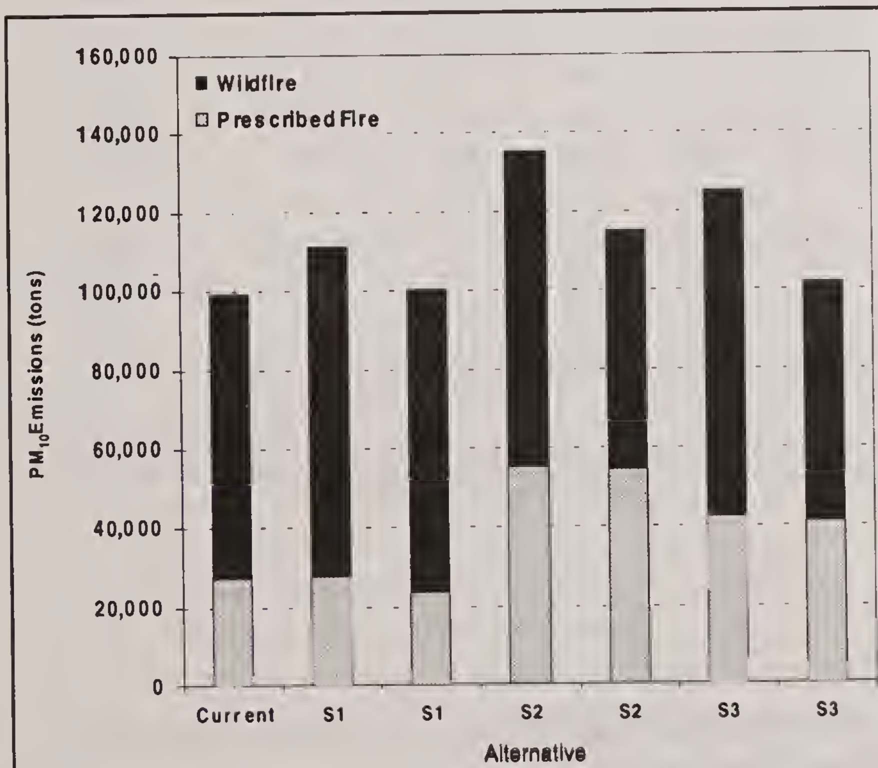


Figure 4-9. Expected Average Annual Emissions (Tons) of PM_{10} for Prescribed Fire and Wildfire, by Alternative. Source: J.A.K. Snell, personal communication, 1999.

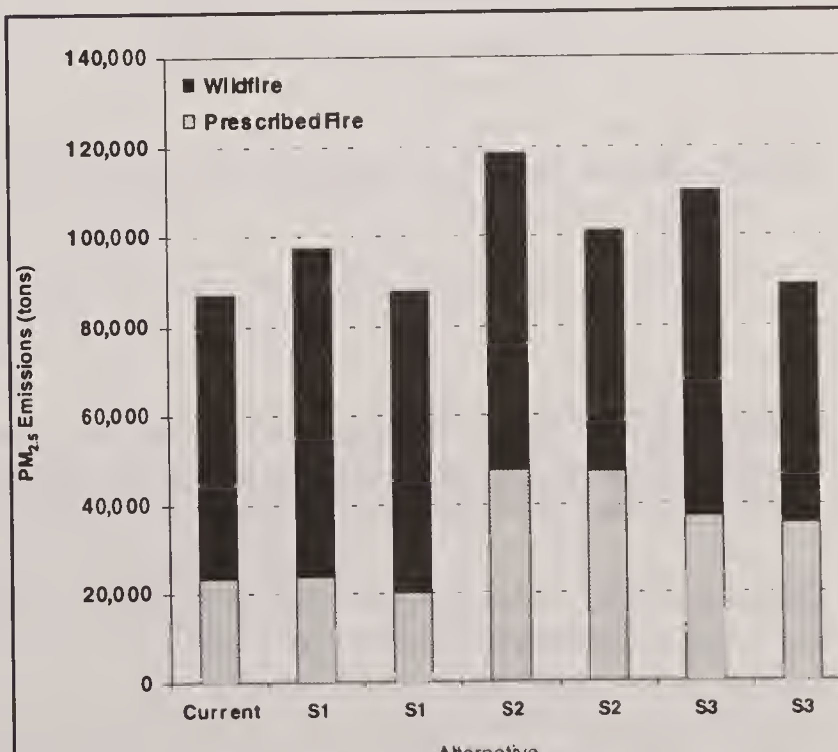


Figure 4-10. Expected Average Annual Emissions (Tons) of $PM_{2.5}$ for Prescribed Fire and Wildfire, by Alternative. Source: J.A.K. Snell, personal communication, 1999.

Visibility

The number of grid cells where the increase in haziness (decrease in visibility) exceeded one deciview (a 10 percent change in visibility equals 1 deciview) was computed for each alternative (Table 4-9) and for a wildfire scenario (Table 4-11).

A prescribed fire scenario was run to compare equivalent number of acres being burned between a prescribed fire event (152,713 acres; see Table 4-10) and a wildfire event (171,180 acres; see Table 4-11).

The modeling suggests two things: (1) when significant number of acres are being burned during an episode, whether by prescribed fire or wildfire, there will be visibility impacts; and (2) visibility impacts of at least 1 deciview will be about the same when comparing wildfire and prescribed fire assuming a similar number of acres are being burned.

The modeling did not address the magnitude of visibility impairment, such as how many deciview changes can be expected for a given episode. Based on the differences in concentrations for a given episode, comparing Figures 4-3 and 4-4 for prescribed fire (earlier in this section) with Figure 4-11 for wildfires, large wildfires can be expected to cause a greater magnitude of visibility impairment than prescribed fire. However, visibility impacts from prescribed fire are expected to occur more frequently than visibility impacts from wildfire, because the number and size of wildfires varies considerably among years, while prescribed fire activities occur annually, during early to late spring and in the fall.

Table 4-9. Number of 20-km Grid Cells with Impaired Visibility, by Alternative.

Alternative	Time of Year	Prescribed Fire Acres Modeled	20-km Grid Cells with Perceptible Change in Visibility by Day Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Total
Base (S1)	Early Spring	1,586	21	17	17	5	12			72
	Late Spring	1,586	11	13	9	12	16	14	13	88
	Fall	13,883	109	40	76	80	64	147		516
	Total	17,055	141	70	102	97	92	161	13	676
Base+200% (S3)	Early Spring	4,680	28	38	59	46	28			199
	Late Spring	4,680	44	61	33	35	50	15	0	238
	Fall	41,330	295	166	248	224	241	355		1529
	Total	50,690	367	265	340	305	319	370	0	1966
Base+300% (S2)	Early Spring	6,595	46	42	64	37	44			233
	Late Spring	6,595	56	52	38	68	58	15	9	296
	Fall	55,515	399	320	332	334	312	475		2172
	Total	68,705	501	414	434	439	414	490	9	2701

Source: Scire and Tino 1996.

Table 4-10. Visibility Impairment, Prescribed Fire Scenarios.[1]

Modeled Event	Time of Year	Prescribed Fire Acres Modeled	20-km Grid Cells with Perceptible Change in Visibility by Day Day 14	Day 15	Day 16	Day 17	Day 18	Day 19	Total
Base+1000%	Oct 14-19, 1990	152,713	782	805	1,176	941	729	1,038	5,471

[1] This scenario was modeled only for the purposes of comparing wildfire and prescribed fire impacts on visibility when a similar number of acres were burned over a similar number of days, but under different fire intensities and meteorological conditions.

Source: Scire and Tino 1996.

Table 4-11. Visibility Impairment, Wildfire Scenario.[1]

Actual Event	Time of Year	Prescribed Fire Acres Modeled	20 km Grid Cells with Perceptible Change in Visibility by Day Day 8	Day 9	Day 10	Day 11	Day 12	Day 13	Total
100%	Aug 8-13, 1990	171,180	332	402	757	1,077	1,541	1,900	6,009

[1] This scenario was modeled only for the purposes of comparing wildfire and prescribed fire impacts on visibility when a similar number of acres were burned over a similar number of days, but under different fire intensities and meteorological conditions.

Source: Scire and Tino 1996.

Conclusions

Alternatives S2 and S3 would increase the amount of prescribed burning conducted for forest and rangeland management, and over the 100-year planning period could be expected to reduce the amount of wildfire activity for the project area by about 16 percent (Table 4-3, earlier in this section). The differences between predicted acres burned for Alternatives S2 and S3 are within the variation of error expected from the air quality analysis and would not support suggesting difference in impacts on air quality between the two alternatives. However, over the 100-year planning period, Alternatives S2 and S3, compared to Alternative S1, should be able to reduce the impacts of wildfire.

In general, this analysis reveals that wildfire impacts on air quality may be significantly greater in magnitude than emissions from prescribed burning. This can be attributed to prescribed burning techniques that reduce emissions and to smoke management plans that states and federal agencies have implemented that permit prescribed fires only during meteorological periods favorable to dispersion and avoidance of population centers of smoke.

This analysis provides only a relative assessment of the impacts from wildfire and prescribed fire on air quality. Frequency of the impacts will follow the episodic nature of both wildfire and prescribed fire. For all management strategies, prescribed fire impacts can be expected to occur annually, but only when meteorological conditions allow for good dispersion and under the auspices of state smoke management plans. Significant wildfire impacts would be less frequent; however, when they do occur, violation of NAAQS and significant impact visibility can be expected. Alternatives S2 and S3 would allow an opportunity to reduce fuel accumulations across the landscape and lessen the impacts from wildfire. An analogy would be that prescribed fire acts as a "pressure relief valve" for wildfire.

The air quality modeling suggests that prescribed burning particulate emissions, when considered alone for both Alternatives S2 and S3, may not cause widespread regional-scale exceedances of the National Ambient Air Quality Standards. However, evaluation of ambient air and compliance with the NAAQS is based on the cumulative impacts from all sources of air pollution on ambient air. This study was done at a 20 km and 4 km resolution, and ambient air (background) concentrations were not used. Thus, conclusions of NAAQS compliance cannot be made of this programmatic EIS.

This modeling analysis assumes that local analysis will be done to assess the possibility for localized exceedances of the NAAQS caused by prescribed burning emissions.

It may also be assumed that state smoke management meteorologists consider the cumulative effects of emissions from other sources (such as road dust and agricultural dust and burning) during the development of daily smoke management instructions, and that state smoke management program managers will consider these sources during development of the smoke management plan submitted for approval (as a component of the state Smoke Implementation Plan) to the EPA.

The modeling results do suggest that regional-scale degradation of visibility is possible because of prescribed burning emissions.

The increased use of prescribed fire described in Alternatives S2 and S3 parallels national trends. The National Wildfire Coordinating Group (NWCG) Fire Use Working Team sanctioned an interdisciplinary and interagency working framework for coordinating development of modeling and data systems to support balancing the increased use of prescribed fire in the context of reducing local and regional impacts of fires on air quality (Sandberg et al. 1999). A number of modeling and data system enhancements are currently under development by the Joint Fire Sciences Program of the USDA Forest Service and the U. S. Department of Interior. These systems include the modeling of meteorological conditions and smoke dispersion. The Forest Service and BLM also have developed a data system to support prescribed burning and to assist the states of Oregon and Washington with emission tracking under their respective state smoke management plans. This data system is available for use over a much broader geographic scope. The use of more sophisticated models during the implementation of prescribed burning, together with enhanced monitoring of emissions, will help minimize possible impacts from the use of prescribed fire. The inherent limitations of any model used at the programmatic scale highlight the importance of the cooperative development and use of operational smoke management models by the states, with assistance by the Forest Service, BLM, and EPA.

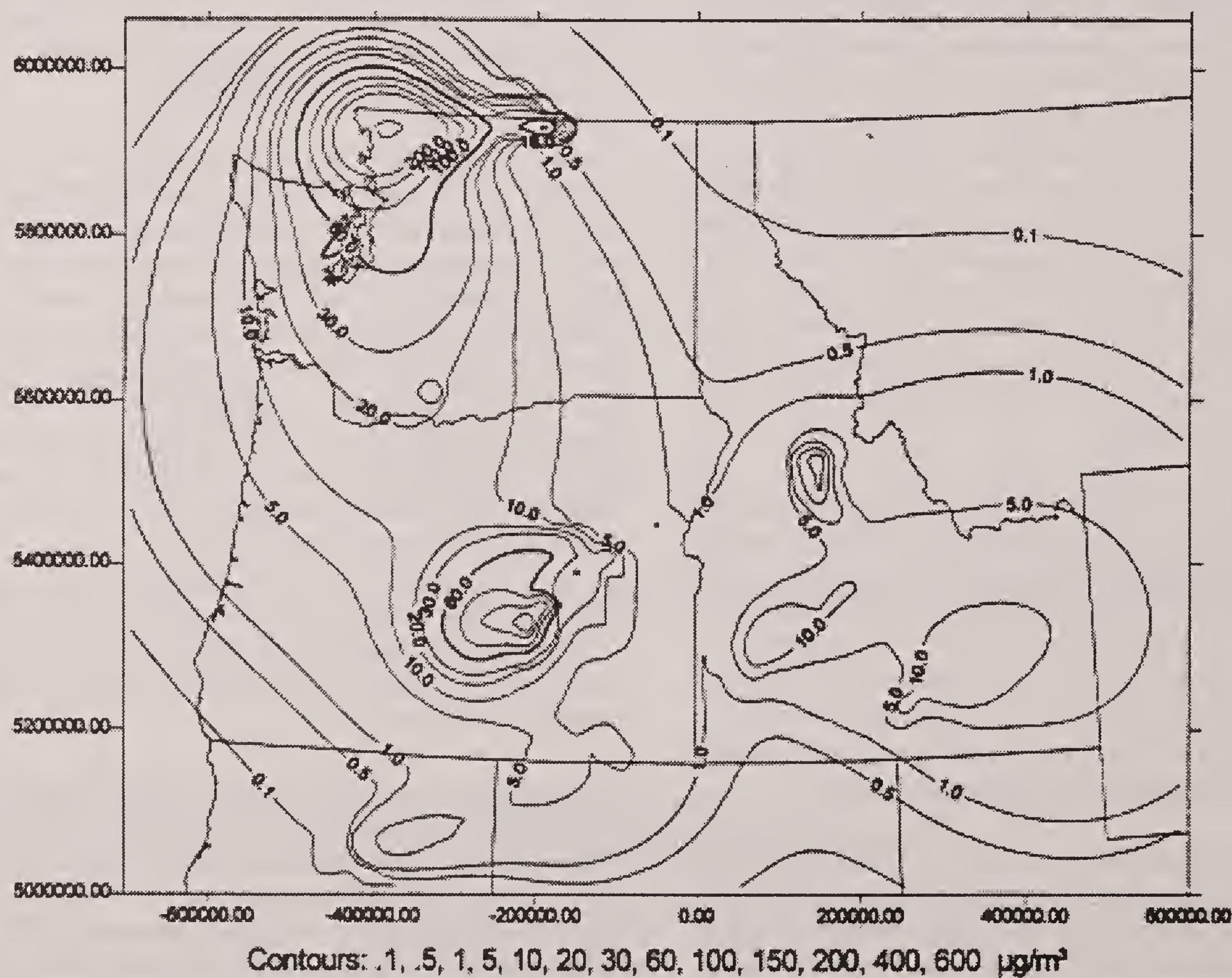


Figure 4-11. $PM_{2.5}$ Emission From Wildfires, August 11, 1990. (Using a 20 km grid; contours in $\mu G/m^3$).
Source: Scire and Tino 1996.

Landscape Dynamics Component: Terrestrial (Upland) Vegetation

This section presents the effects of the alternatives on succession/disturbance regimes and potential vegetation groups. A summary of key effects for succession/disturbance and vegetation composition and structure is presented first, followed by methods for estimating effects on terrestrial (upland) vegetation. Effects of the alternatives are then presented for succession/disturbance and for potential vegetation groups.

Summary of Key Effects and Conclusions

It has taken more than a hundred years to reach the present condition of the terrestrial uplands characterized by increasingly larger and more severe wildfire, increased invasion of noxious weeds, more insect and disease problems, and changes in the mix of vegetation types on the landscape that once provided for a balance of wildlife species that use them. Although these changes came on slowly at first, the movement away from historical succession and disturbance regimes increased over time; currently the movement away from historical regimes is proceeding rapidly with a great momentum.

Because it took a long time to reach this condition, remedies will not be easy, inexpensive, or quickly achieved. In general there is little difference among the long-term effects of the Supplemental Draft EIS alternatives at the basin-wide scale. On BLM- and Forest Service-administered lands alone, the differences among alternatives are generally still small. When restoration activities are concentrated into high restoration priority subbasins, then Alternative S2 emerges as the most effective alternative, followed by Alternative S3 and lastly, Alternative S1. However, even in the high restoration priority subbasins there is a considerable time lag involved in moving vegetation closer to historical conditions. To further complicate the situation, the drier parts of the project area seem to take even longer to restore because the vegetation responds more slowly and the methodology is less refined in more arid ecosystems. Higher amounts of restoration activities applied to forest and rangelands alike would be expected to result in greater differences between Alternatives S2 and S3 and Alternative S1.

Succession/Disturbance

- Alternative S2 is expected to do a better job of **repatterning vegetation on the landscape** to provide a proper mix of habitats and so that vegetation would be resilient to disturbance and sustainable in the long term.
- Effects from **uncharacteristic wildfire** are expected to increase slightly under Alternative S1 and decrease in Alternatives S2 and S3, with Alternative S2 slightly better on Forest Service- and BLM-administered lands in the long term.
- **Uncharacteristic insect and disease effects** are expected to remain near current levels on Forest Service- and BLM-administered lands in the long term. Alternative S2 should be slightly better than Alternatives S1 and S3 would likely be in between.
- The higher concentration of restoration activities in **high restoration priority subbasins** is expected to lead to a more healthy landscape in those areas under Alternatives S2 and S3.

Vegetation Composition and Structure

- Alternative S2 is expected to increase the extent of old forests to near historical levels, slightly more than Alternative S3, followed by Alternative S1 on Forest Service- and BLM-administered lands in the long term.
- Alternative S2 is expected to increase the extent of **old forests in the single story structural stage** more than Alternative S3. Both are expected to fall short of historical levels. Alternative S1 would also increase the extent but fall far short of historical on Forest Service- and BLM-administered lands in the long term.
- All alternatives are expected to increase extent of **ponderosa pine.** Alternatives S2 and S3 would increase extent to near historical levels, while Alternative S1 would result in above historical levels (go too far). Alternatives S2 and S3 would do a better job of increasing the vegetation types that have declined substantially from historical to current periods within this cover type.

- Alternatives S2 and S3 are expected to increase the extent of **western white pine** to slightly below historical levels. Alternative S1 would result in levels lower than Alternatives S2 and S3.
- All alternatives are expected to increase the extent of **whitebark pine**, but none would be able to prevent the future decline of the late seral single story structure.
- Over the long term, all three alternatives are projected to reverse the major vegetation changes within the woodland and cool shrub PVGs (that is, woody species encroachment and increasing density in shrublands and/or herblands) on BLM- and Forest Service-administered lands. Reversal would be more pronounced in Alternatives S2 and S3 than in Alternative S1.
- Vegetation types that have declined substantially in geographic extent from historical to current periods in the project area (for example, mountain big sagebrush, fescue-bunchgrass, and wheatgrass bunchgrass) would increase in the woodland and cool shrub PVGs as a result of the reversal in trend for encroachment of woody species.
- The rate of expansion of noxious weeds and other exotic undesirable plants on BLM- and Forest Service- administered lands in the project area as a whole would be slowed in Alternatives S2 and S3 more so than in Alternative S1. However, for all alternatives the extent of noxious weeds and other exotic undesirable plants would continue to increase.
- The wheatgrass bunchgrass and fescue-bunchgrass vegetation types within the dry grass PVG, and the big sagebrush vegetation type within the dry shrub PVG, all of which have declined substantially in geographic extent from historical to current periods, would continue to decline in their respective PVGs and trend away from historical amounts.

Methodology: How Effects on Terrestrial (Upland) Vegetation were Estimated

Effects of the alternatives on the terrestrial (upland) environment hinged to a great degree, but not solely, on a series of models created by the Science Advisory Group (SAG). These models were designed to simulate the management direction as it would reasonably be implemented during the next decade and the next century. Many of these models were developed previously during the formulation of the *Scientific Assessment* (Quigley and Arbelbide 1997) and during the *SIT Evaluation of the Draft EIS Alternatives* (Quigley, Lee, and Arbelbide 1997). Some new models, such as the Terrestrial Species Bayesian Belief Network Models (see sidebar in the Terrestrial Species section of this chapter and Quigley 1999 for description of the models), were created specifically for the science evaluation of the Supplemental Draft EIS alternatives.

Models simulated vegetation, succession/disturbances (such as livestock grazing pressure, wildfire, insect and disease mortality, and drought), management activities (such as prescribed burning, thinning, wildfire rehabilitation seedings), and other processes, which collectively operate across landscapes. The models integrated these variables so that disturbances were able to influence vegetation change and management activities. Vegetation conditions influence the frequency and intensity of disturbances, which influence the complexity of how lands respond to climate and human activities and uses in the interior

Columbia Basin. Outcomes of these simulation models were used as inputs to the Terrestrial Species Bayesian Belief Network (BBN) Models.

Landscape modeling methods used to evaluate effects of the management direction in the Supplemental Draft EIS were similar to the methods used to evaluate effects of the Draft EIS management direction. In both instances, a large part of what drove the landscape modeling was the assignment of management prescriptions, which varied in emphasis from traditional commodity management to emphasis on conservation with little commodity management, to active ecological restoration. Some key differences in the two evaluations are noted here:

- In the Draft EIS evaluation of effects (Quigley, Lee, and Arbelbide 1997), the selection and assignment of management prescriptions was performed by the Science Integration Team (SIT). In the Supplemental Draft EIS analysis of effects, management prescription selection was more of a joint Science Advisory Group (SAG)-EIS Team task, with the EIS team providing input as to management prescriptions that best fit the intent of the management direction. Similar to the Draft EIS evaluation, management prescription assignment for the Supplemental Draft EIS evaluation was ultimately performed by SAG.
- In the Supplemental Draft EIS evaluation, underlying land use plans and existing recovery plans were considered in the modeling of all alternatives, and biological opinions were considered to the extent possible given the coarseness of the data and analysis in the modeling of Alternative S1 (no-action alternative). Selection and assignment of management prescriptions for modeling Alternative S1 were changed to reflect these considerations.
- The "starting line" for Alternative S1, which was a reasonable reflection of current conditions, incorporated the 1988–1997 trend in certain activities (for example, timber harvest, livestock grazing levels) reported by BLM and Forest Service administrative units within the project area.

SAG information additional to model outcomes focus on several key rangeland issues and an independent review of the management direction and landscape variables by Johnson and Kingery (1999). Professional judgement in Johnson and Kingery (1999) proved particularly useful for issues such as biological crusts. These issues were difficult to model because of lack of inventory information on their condition in the project area.

The identification of and reporting of effects for cover type–structural stage combinations that have declined substantially from historical to current periods (that is, landscape vegetation types in the Terrestrial [Upland] Vegetation section, and terrestrial source habitats in the Terrestrial Species Component section) were based on the cover types and structural stages used in both the landscape and terrestrial modeling and was an EIS team-developed analysis. The premise used by the EIS team in identifying landscape vegetation types and terrestrial source habitats that have declined substantially from historical to current was that decline in these vegetation types or source habitats was associated with uncharacteristic succession/disturbance regimes and land use changes. In general, for the landscape vegetation types or terrestrial source habitats, for which restoration management direction was written, the EIS team used the cover type analyses and noxious weed/exotic undesirable plant analyses in Hann, Jones, Karl, et al. (1997) as support for the premise and as support for the inclusion of these vegetation types or source habitats in the Supplemental Draft EIS.

For further information on landscape effects analysis see Hemstrom et al. (1999).

Rationale for Qualitative Interpretations of Modeling of Management Alternatives

The models developed by the SAG provide overall predictions which are useful in evaluating the effects of the alternatives. The SAG and the EIS Team evaluated the predictions of the models and identified a few instances where model predictions could be improved. These instances are discussed in the following paragraphs.

Restoration to Historical Levels

The intent of management direction in Alternatives S2 and S3 is to manage toward or within the range of historical variability and to repattern vegetation to match the landscape. These alternatives also include direction to restore certain source habitats that have declined substantially in geographic extent from historical to current periods, which would realistically stop as repatterning was completed. However, it was

not possible to program the landscape model to stop the conversions if appropriate levels were reached. This led to some terrestrial communities possibly being increased above the level that should occur on the landscape, which caused others to be decreased below that level, both of which could adversely affect the assessment of departure from historical levels (HRV departure).

Late Seral Forest Development

The model moved most mid seral forest toward late seral forest. However, not all of the mid seral forest is expected to become late seral forest. In the cool and dry portions of these environments, an absence of disturbance results in some of the mid seral forest becoming over stocked and stagnated, thus slowing development to the late seral stage. A recent analysis on the Salmon-Challis National Forest (Bassford and Long, personal communication, 1999) indicates that stagnation of mid seral stands may have led to the over-estimation of levels of late seral forest in Alternative S1. Alternatives S2 and S3, which apply more disturbances (such as thinning and prescribed fire), would likely overcome the stagnation of mid seral forests in areas with more intensive restoration than Alternative S1.

Rangeland Condition/Livestock Management

The prescriptions available in the landscape model do not completely reflect the rangeland direction related to livestock management in Alternatives S2 and S3. Therefore, the predicted effects probably do not completely reflect the results of implementing direction in Alternatives S2 and S3. It was estimated by the SAG that rangeland conditions would probably be better under Alternatives S2 and S3 than predicted as changes in livestock grazing management were implemented. (See the Livestock Grazing section, under Factors Influencing Ecosystem Health.)

Exotic Undesirable Plants, including Legally Declared Noxious Weeds

The predicted reduction in extent of infestation of exotic undesirable plants was overestimated in the modeling effort. This is a result of the current extent of infestations of exotic undesirable plants within native plant communities being underestimated for the project area. Accurate extent could not be estimated with aerial photography and remote sensing, because exotic undesirable plants could not with certainty be distinguished from native vegetation in all cases. The effects in this section will discuss predicted trends and should portray the relative degree of differences between alternatives.

Succession and Disturbance Processes

Effects of the Alternatives on Succession and Disturbance Processes

Historically, valley, foothill, and mountainous terrain within the project area was dominated by patterns of vegetation that were driven and maintained by variable, yet generally predictable, succession/ disturbance regimes on the landscape (see Chapter 2). Since that time, traditional commodity and reserve management strategies, coupled with fire suppression, have substantially changed the patterns of succession and disturbance regimes. A result is large increases in effects from uncharacteristic disturbances compared to historical times. Alternative S1, the no-action alternative, would not go as far in changing this traditional management direction as Alternatives S2 and S3.

The intent of Alternatives S2 and S3 is to repattern the vegetation on the landscape to make it more consistent with the historical landscape patterns and resilient to natural and human-caused disturbances such as wildfire, insects and disease, livestock grazing, and timber harvest. One of the yardsticks that will be used to judge which alternative is best, from an ecological perspective, is which alternative would come closest to repatterning the mix of habitats on the landscape to be similar to the range of vegetation and disturbance regimes that existed before European settlement. This is called the historical range, referred to as "historical" in subsequent sections. Another measuring stick is how well the alternatives would reduce the effects from uncharacteristic disturbances.

Forest Species Composition and Structure

This section provides a summary of how the alternatives would affect the species composition and structure of forestlands over the long term. It describes how the extent of species would increase or decrease over time and how structural stage (the developmental stage of the species) has to be considered when evaluating the effectiveness of the alternatives in restoring the patterns of habitats across the landscape.

Although the total extent of a particular species may have increased or declined from historical to current periods, not all structural stages (see Table 2-6a, Forest Structural Stages, in Chapter 2) within that species would have necessarily shown corresponding increases or declines. In many cases, a decline in one structural stage has resulted in increases in one or more other structural stages for that species. For example, the total amount of ponderosa pine might have increased in numbers of acres, but it may contain less old forest single story ponderosa pine forest and a lot more young forest. Therefore, it is important to consider not only the trend of the species as a whole under all alternatives, but also how the alternatives would address individual structural stages within that species, particularly the species/ structural stage combinations that have declined substantially in geographic extent from historical to current periods.

Species Composition

This section describes the mix of different species of trees that would be expected over the long term under the different alternatives. Types of trees growing in a forest can be classified as shade-intolerant and shade-tolerant. Shade-intolerant species need full sunlight to establish and grow; shade-tolerant species do not. (See Chapter 2 for discussion of shade tolerance and intolerance, with lists of common tree species in each category.)

Basin-wide, the total extent of *shade-intolerant* species has declined substantially from historical to current periods. Overall, under any of the alternatives, the extent of these shade-intolerant species would expand on Forest Service- and BLM-administered lands in the long term. The decreasing trend in ponderosa pine is expected to reverse under all alternatives and would increase in extent to above historical levels, with the largest increase in Alternative S1. However, Alternatives S2 and S3 would increase the structural stages of ponderosa pine that have declined substantially in geographical extent from historical to current periods more than Alternative S1. Likewise, all alternatives are expected to increase the extent of western white pine, with greater increases in Alternatives S2 and S3 than Alternative S1, although none of the alternatives would reach historical levels. Alternative S1 is expected to expand the extent of the western larch the most, with little difference between Alternatives S2 and S3. Alternative S1 would be above historical levels while Alternatives S2 and S3 would be slightly below and closer to historical levels. Lodgepole pine would decrease in extent below historical levels for all alternatives because of severe disturbances such as bark beetles and/or wildfire. Alternative S1 would decrease lodgepole pine the most, with Alternatives S2 and S3 remaining closer to historical levels.

Increases in the extent of shade-intolerant species would result from natural disturbance (wildfire) reducing the extent of shade-tolerant species under all alternatives (because shade-tolerant species are fire sensitive), and from extensive restoration activities (human-caused disturbance such as thinning, prescribed fire, stewardship harvest) called for in Alternatives S2 and S3. Also, Alternatives S2 and S3 would benefit from direction to increase the extent of vegetation types that have declined substantially in geographic extent from historical to current periods, which often consist of shade-intolerant species.

Shade-tolerant cover types have generally increased from historical to current. All alternatives would reduce the extent of Douglas-fir below historical levels, with Alternatives S2 and S3 at slightly higher levels and closer to historical than Alternative S1. All alternatives, with little difference among them, would reduce the grand fir/white fir cover type below current levels, but none would approach historical ranges. However, there would be differences among alternatives in high restoration priority subbasins because of the higher emphasis on and concentration of restoration activities in Alternatives S2 and S3. The Engelmann spruce/subalpine fir cover type is expected to decline substantially under all alternatives, with all alternatives expected to go slightly below historical levels. There should be little difference among alternatives. The reason for no difference in the Engelmann spruce/subalpine fir cover type among alternatives is the low priority for restoration in the cold environments where these species grow.

Increases in the extent of shade-tolerant species would result from a lack of low-level disturbances that would have removed shade-tolerant species (which are also fire sensitive) and would have promoted more fire-resistant shade-intolerant species.

Stand Structure

Stands of trees can be classified based on their stage of development. This section describes for the alternatives the structural stages of forest and their extent that can be expected over the long term. (See Chapter 2 for further discussion.)

Old Forests

Old forests are of special concern because of their current scarcity. All alternatives are expected to increase the extent of old forests basin-wide, on Forest Service- and BLM-administered lands, in the long term (Map 4-1).

The extent of shade-intolerant old forest species, such as ponderosa pine, lodgepole pine, western larch, and western white pine, are expected to increase under all alternatives. Alternative S2 would likely increase in extent slightly more than Alternative S3, followed by Alternative S1. However, none of the alternatives would result in the shade-intolerant old-forest species, as a whole, reaching the historical extent in 100 years. The extent of shade-intolerant old forest in the *multi-story* structure would go above historical levels in the long term with little difference among alternatives. In the scarcer shade-intolerant *single story* structure, however, none of the alternatives would achieve historical levels. Alternative S2 is expected to increase the extent slightly more than Alternative S3, which should come out substantially better than Alternative S1. The reason that none of the alternatives would achieve historical levels of shade-intolerant, single story structure in 100 years is because of the long timeframes required to establish old-forest characteristics and the lack of high enough concentrations of restoration activities in much of the project area.

The differences among alternatives are due to the increased amount of thinning, prescribed fire, stewardship harvest, and direction to protect and increase the extent of old forest types that have declined substantially in geographical extent from historical to current periods found in Alternatives S2 and S3 compared to Alternative S1.

The current overall trend of increasing extent of shade-tolerant old-forest species such as Douglas-fir, grand fir/white fir, and subalpine fir is expected to continue with little difference among alternatives. In the *multi-story* structural stage, Alternatives S1 and S3 would increase the extent slightly more than Alternative S2, but all would be more than double the historical extent. The shade-tolerant *single story* structure, however, has declined slightly from historical because of lack of disturbances and subsequent ingrowth and development of multiple canopy layers. Alternative S2 should by far result in the greatest increase of this single story structure (nearing historical extent), followed by Alternative S3, then Alternative S1.

Early Seral Forest

Early seral forest, with a current extent just above historical levels, is expected to decrease slightly throughout the project area under all alternatives. This would result in the extent being slightly below historical levels. The early seral forest is unique compared to other vegetation types because it is short-lived in the absence of very frequent disturbance. Historically, early seral forests came and went in patches on the landscape at time intervals determined by the predominant disturbance regime; as it was waning in one area, it was being created somewhere else on the landscape. In Alternative S1, areas of early seral forest are created by stand-replacing disturbance (wildfire, insects and disease) and traditional timber harvest. In Alternatives S2 and S3, areas of early seral forest would be created by smaller amounts of stand-replacing disturbance, establishing areas of regeneration for shade-intolerant species such as western white pine and western larch, and intentionally creating early seral habitat where it is needed on the landscape.

Mid Seral Forests

In mid seral forests of the project area, which have increased in extent substantially from historical, Alternative S3 would reduce the extent the most, followed by Alternative S2. Alternative S1 would reduce the extent of mid seral forests the least, and none of the alternatives would reach historical levels. Changes in the mid seral forest in Alternative S1 would be due to succession to late seral forest or to stand-replacing disturbance or traditional harvest that converts it back to early seral forest. Changes in Alternatives S2 and S3 would likewise be due to succession into late seral forest, as well as some stand-replacing disturbances or intentional activities that cause transitions to early seral forest.

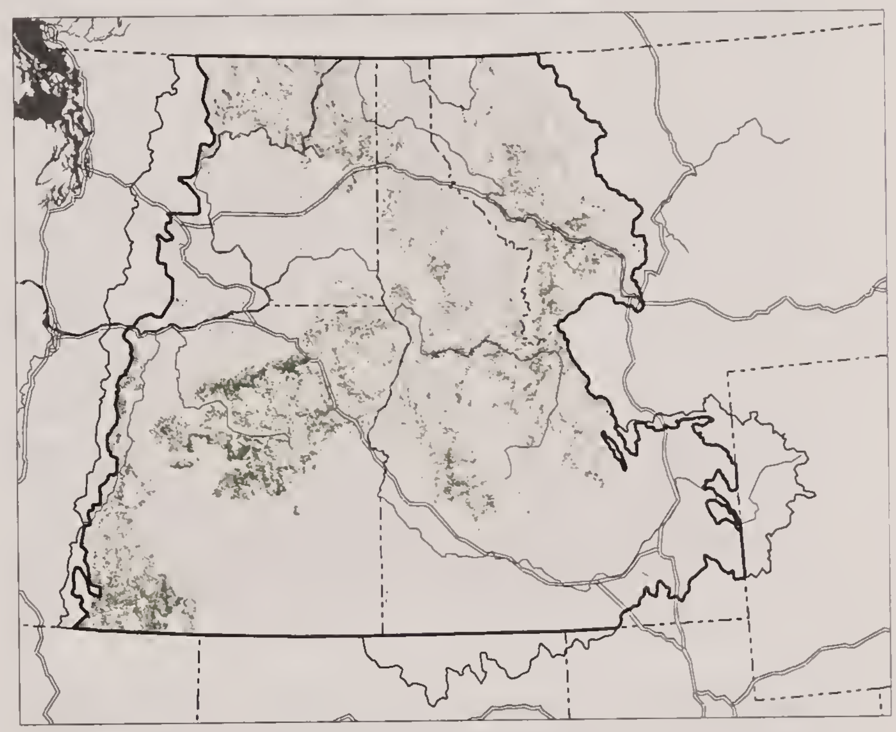
Patterns of Composition and Structure

Another factor to consider in this comparison of alternatives is the pattern of species composition and structure on the landscape. Alternatives S2 and S3 emphasize placement of these vegetation types in appropriate patch sizes and locations where they are consistent with the native disturbance regime, landform, climate, and biological and physical characteris-

Current

Alternative S1

Map 4-1. Expected Extent of Old Forest

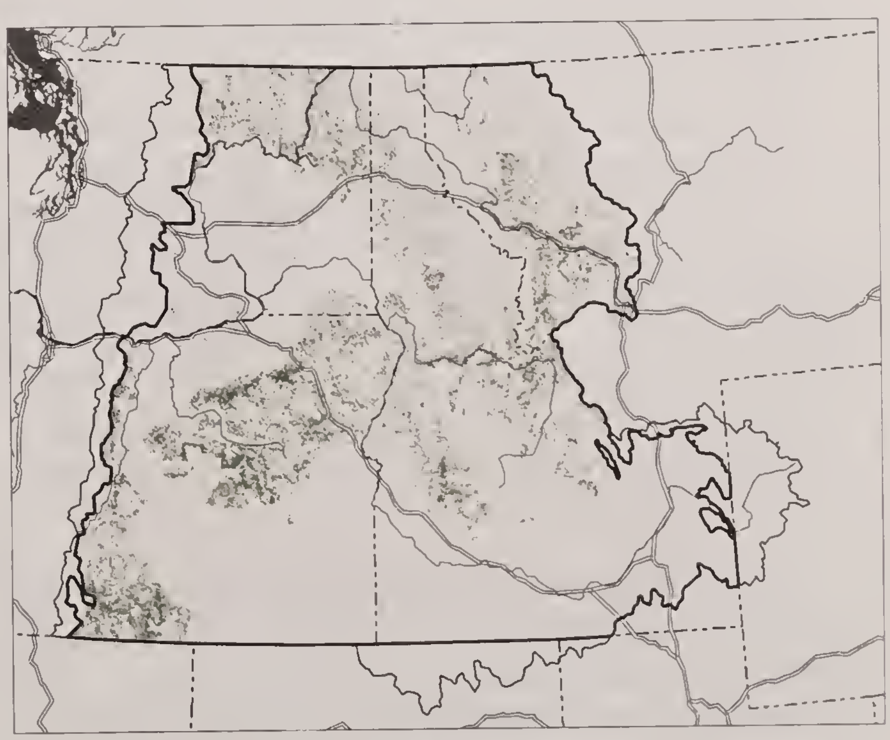


Alternative S2

- Late-seral Forest
- Major Rivers
- Major Roads
- Supplemental Draft EIS Area Border

INTERIOR COLUMBIA
BASIN ECOSYSTEM
MANAGEMENT PROJECT

Supplemental Draft EIS Area
2000



Alternative S3

tics of the ecosystems. The result should be that under Alternatives S2 and S3 the vegetation types (species-structural stage combinations) would be more resilient to disturbance and more sustainable over time than with Alternative S1.

Disturbance

This section describes the dominant disturbances affecting succession of vegetation that are influenced by the alternatives.

Fire Regime

Currently about one percent of the Forest Service- and BLM-administered lands in the ICBEMP project area are affected by fire activity on an average yearly basis. This is a combination of wildfire, prescribed fire, and "wildland fire use for resource benefit" (formerly referred to as prescribed natural fire). Alternative S1 should maintain current levels of fire activity, while Alternatives S2 and S3 would sharply increase fire activity, with levels higher in Alternative S2 than Alternative S3 in the long term. The largest increases in fire activity are expected in the Southeast Oregon RAC, followed by the John Day-Snake RAC, the Butte RAC, the Upper Columbia-Salmon-Clearwater-R4 RAC, and the Upper Columbia-Salmon-Clearwater-R1 RAC. The Lower Snake River RAC and the Upper Snake River RAC are expected to show no increases and declines in fire activity respectively in the long term (Map 4-2). Other RAC/PACs would show lesser increases in fire activity.

Prescribed fire amounts are expected to differ greatly from Alternatives S2 and S3 to Alternative S1 on Forest Service- and BLM-administered lands in the long term (Map 4-3). Alternatives S2 and S3 would show substantial increases in many parts of the project area, while Alternative S1 would be expected to maintain current levels on average. Alternative S2 would treat more acres using prescribed fire than Alternative S3. Most likely, the greatest increases in prescribed fire and other fuels management activities under Alternatives S2 and S3 would be found in the John Day-Snake RAC, the Southeast Oregon RAC, the Upper Columbia-Salmon-Clearwater R1 RAC, the Upper Columbia-Salmon-Clearwater R4 RAC, the Eastern Washington-Cascades PAC, and the Upper Snake River RAC.

Long-term projections indicate that Alternatives S2 and S3 would have greater increases in "wildland fire use for resource benefit" than Alternative S1, although none of the alternatives would result in substantial increases (Map 4-4). The greatest increases would be expected in the John Day-Snake RAC, the Eastern Washington-Cascades PAC, the Upper Snake River RAC, and the Southeast Oregon RAC.

Because of activities such as prescribed fire, "wildland fire use for resource benefit," and fuel reduction, Alternatives S2 and S3 are expected to result in a smaller increase in the level of wildfire on Forest Service- and BLM-administered lands in the long term than Alternative S1 (Map 4-5). RAC/PACs where increases would be expected in the amount of wildfire are the John Day-Snake RAC, the Upper Columbia-Salmon-Clearwater R4 RAC, and the Lower Snake River RAC (all alternatives). Several RAC/PACs could experience lesser increases in wildfire activity, led by the Upper Snake River RAC (all alternatives), and including the Eastern Washington-Cascades PAC (Alternative S1 only), the John Day-Snake RAC (Alternative S1 only), the Lower Snake River RAC (all alternatives), and the Upper Columbia-Salmon-Clearwater R4 RAC (all alternatives). Wildfire activity is a relatively random process that depends on fuels, ignition, weather, and suppression ability, so these projections have somewhat large confidence bands.

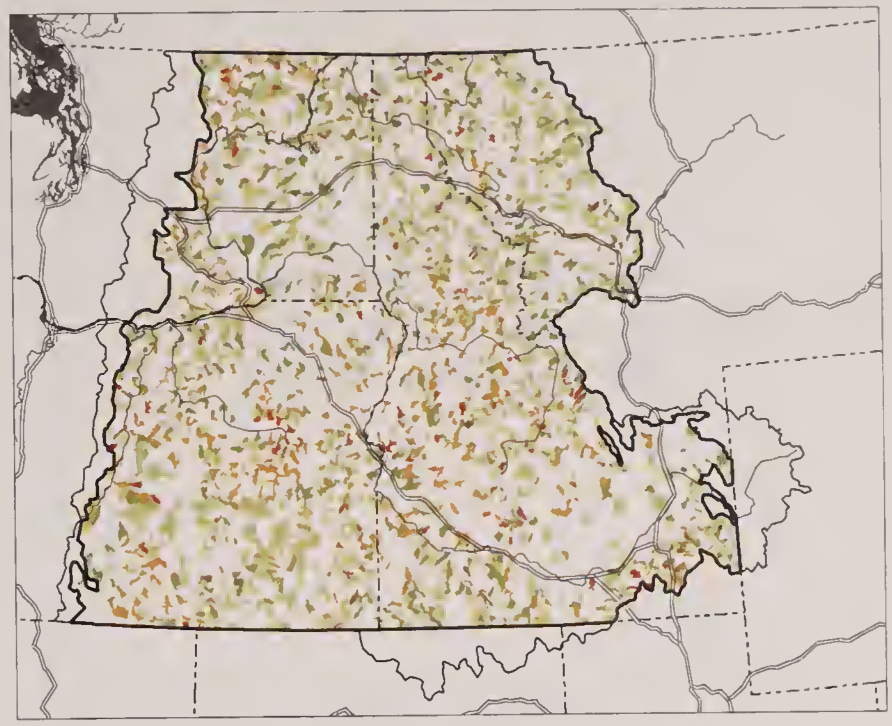
In the high restoration priority subbasins identified in Alternatives S2 and S3, the story is more dramatic. Alternative S1 is expected to have twice the level of uncharacteristic wildfire in the long term in high restoration priority subbasins compared to Alternative S2 . The projected extent of uncharacteristic wildfire is expected to be 2.5 times greater for Alternative S1 compared to Alternative S3 in high restoration priority subbasins. These effects would be a result of the increased amount of prescribed fire and other restoration activities in Alternative S2, and to a slightly lesser extent, Alternative S3.

The extent and severity of wildfires depends on fuel levels and connectivity, topography, weather, vegetation composition and structure, and suppression efforts. Wildfires tend to be bigger currently than historically. However, through prescribed fire and repatterning of vegetation, Alternatives S2 and S3 would attempt to influence fire activities to respond more similarly in patch and pattern to historical ranges than would be expected to occur under Alternative S1. This, in turn should lead to better resiliency and sustainability of vegetation types on the landscape under Alternatives S2 and S3.

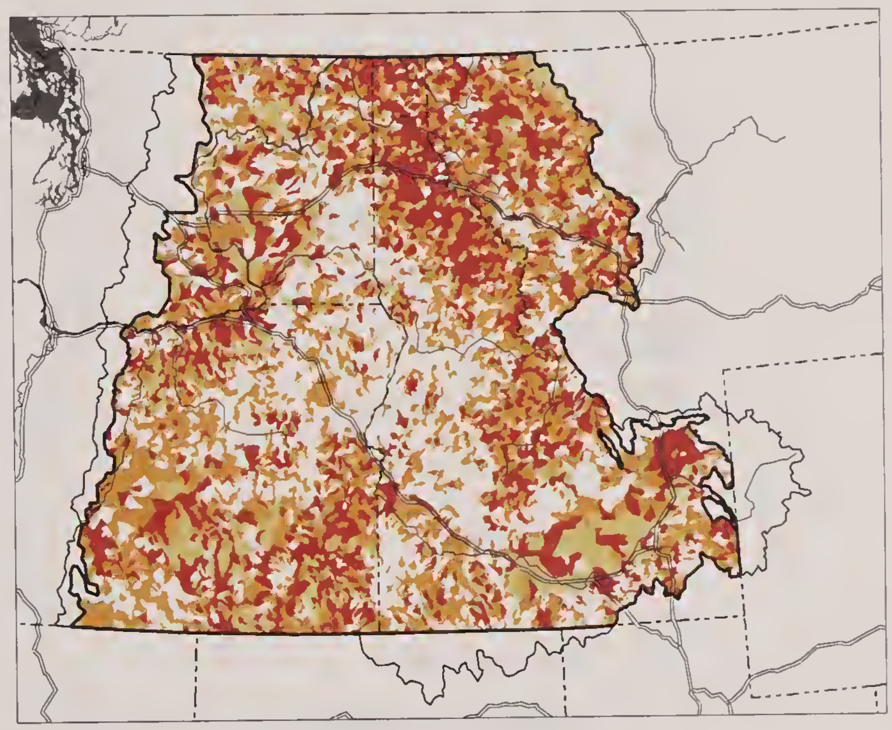
Insects and Disease

Insect and disease activity is an important natural process in the forests at all elevations in the basin.

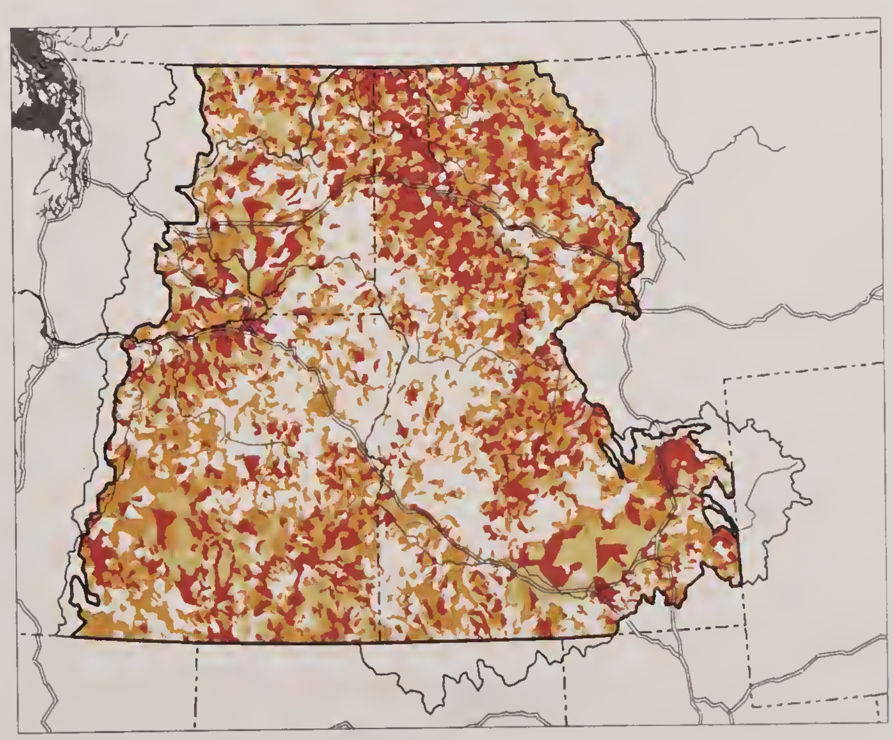
Map 4-2. Fire Activity and Disturbance Classes: Change from Current



Alternative S1



Alternative S2



Alternative S3

- Low to High
- Moderate to High
- Low to Moderate
- High to Low
- High to Moderate
- Moderate to Low
- No Change
- Major Rivers
- Major Roads
- Supplemental Draft EIS Area Border

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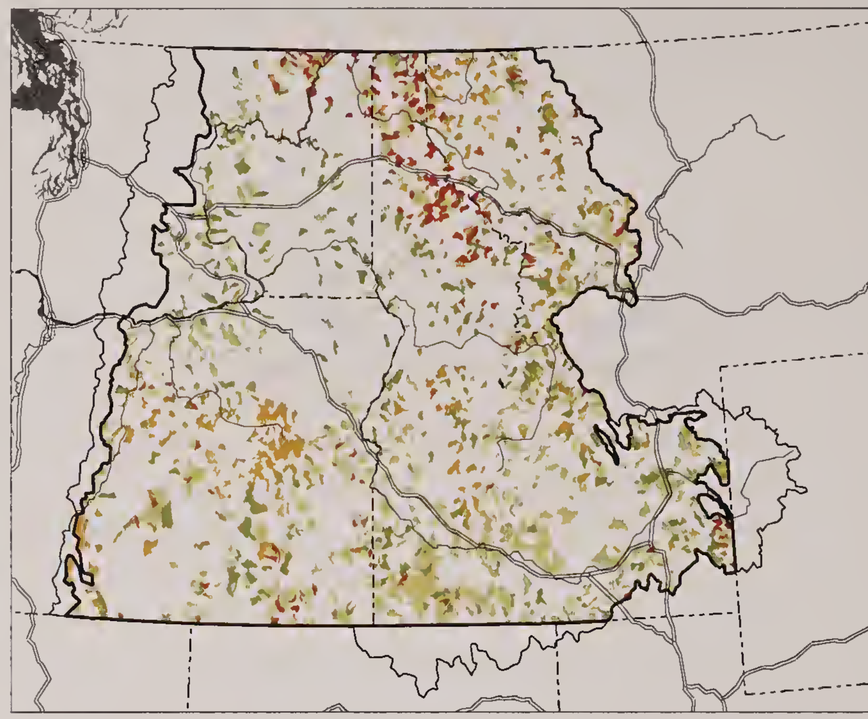
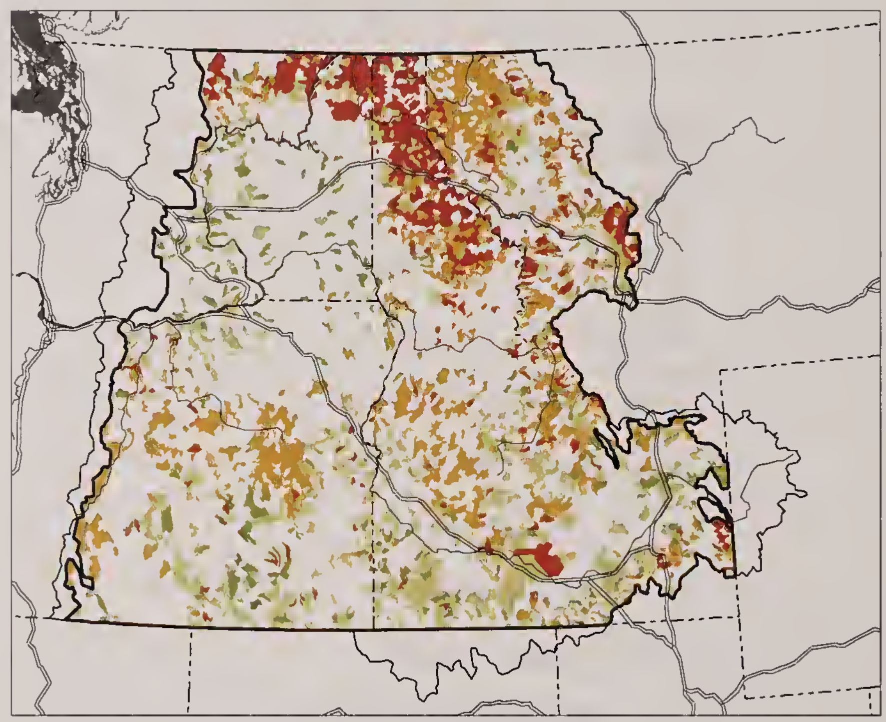
Supplemental Draft EIS Area
2000

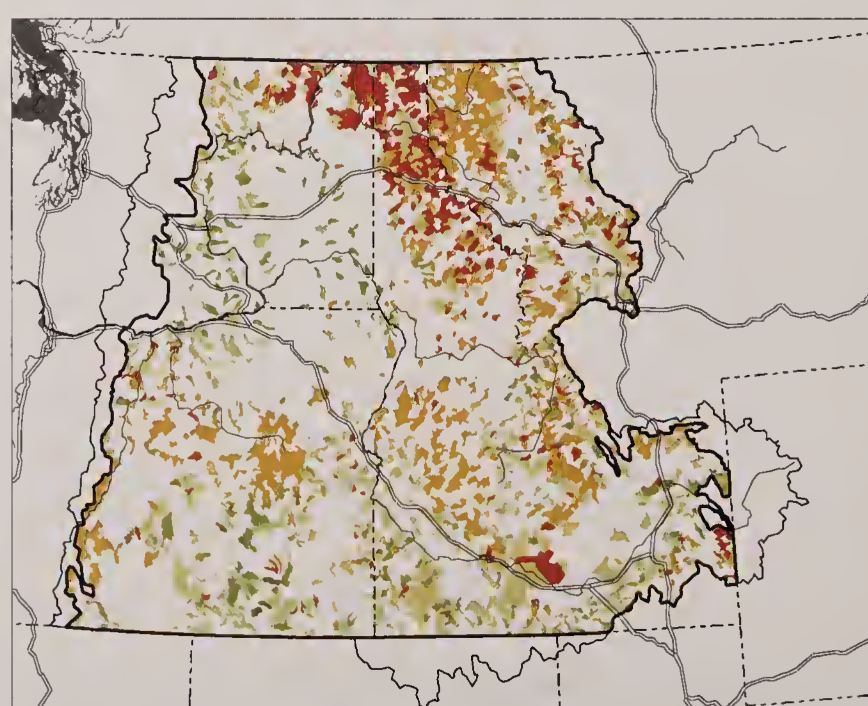
Map 4-3. Prescribed Fire/Fuel Management Activity Classes: Change from Current



Alternative S1



Alternative S2



Alternative S3

- Low to High
- Moderate to High
- Low to Moderate
- High to Low
- High to Moderate
- Moderate to Low
- No Change
- Major Rivers
- Major Roads
- Supplemental Draft EIS Area Border

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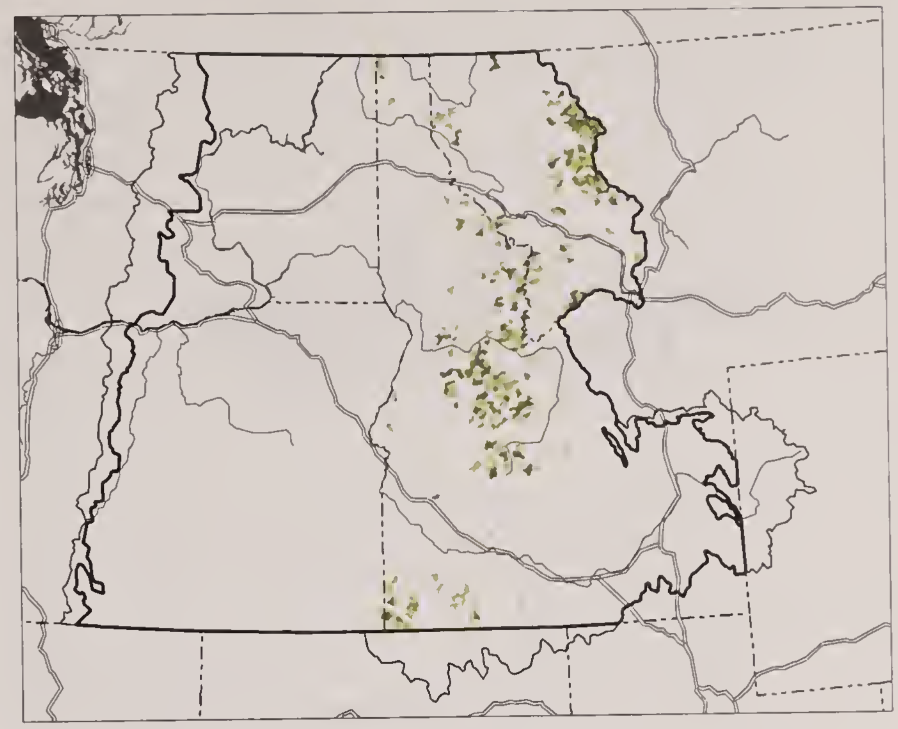
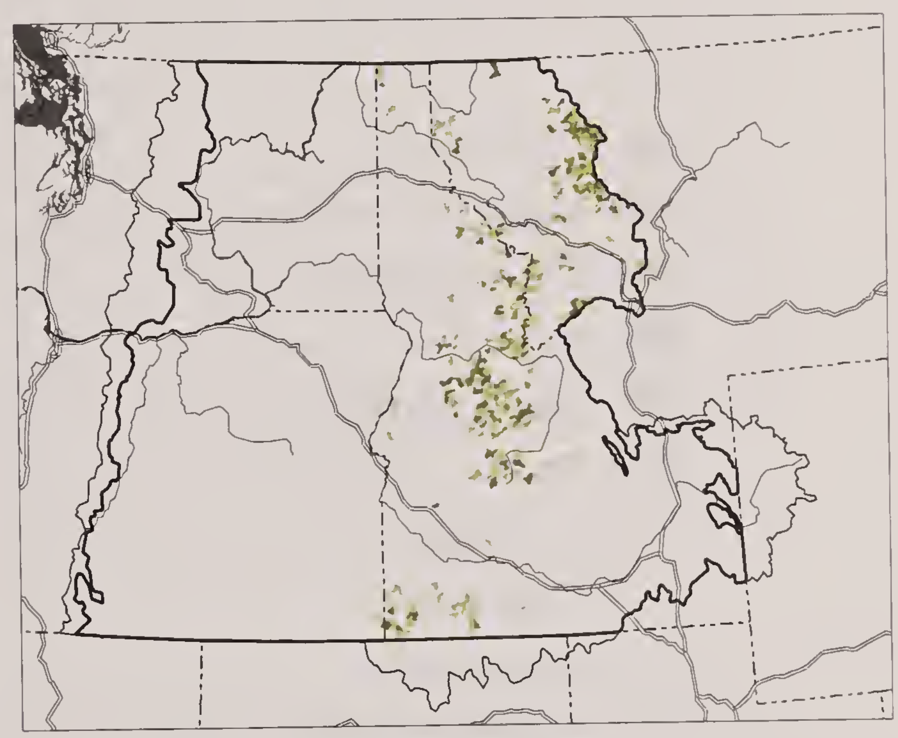
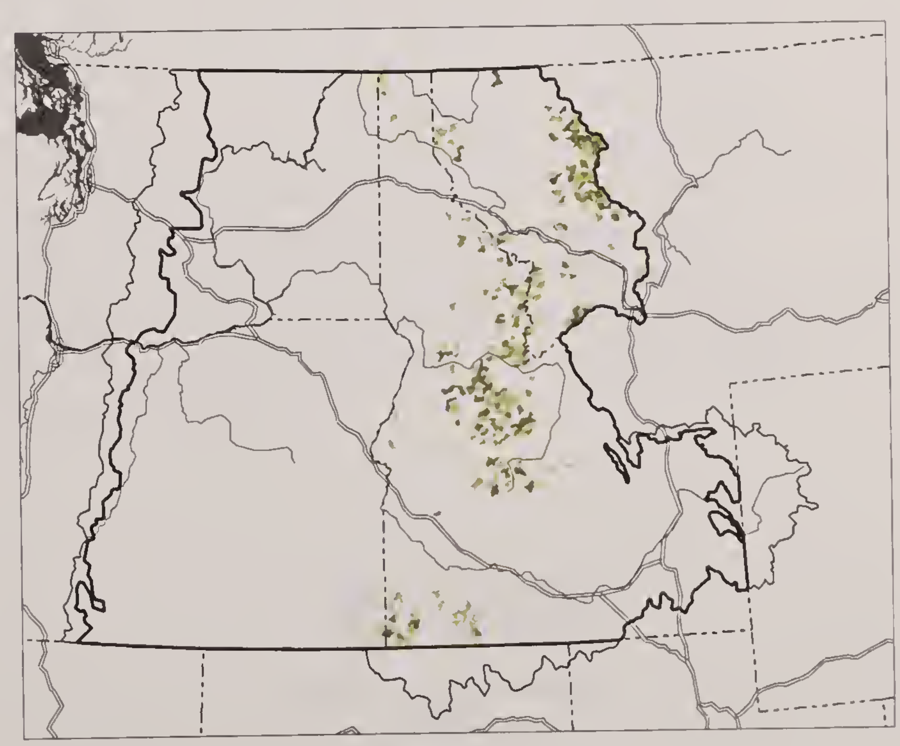
Map 4-4. "Wildland Fire Use for Resource Benefit" Activity Classes: Change from Current



Alternative S1



Alternative S2



Alternative S3

- Low to High
- Moderate to High
- Low to Moderate
- High to Low
- High to Moderate
- Moderate to Low
- No Change
- Major Rivers
- Major Roads
- Supplemental Draft EIS Area Border

INTERIOR COLUMBIA BASIN ECOSYSTEM MANAGEMENT PROJECT

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Map 4-5.
Wildfire Disturbance Classes: Change from Current

Low to High
Moderate to High
Low to Moderate
High to Low
High to Moderate
Moderate to Low
No Change
Major Rivers
Major Roads
Supplemental Draft EIS Area Border

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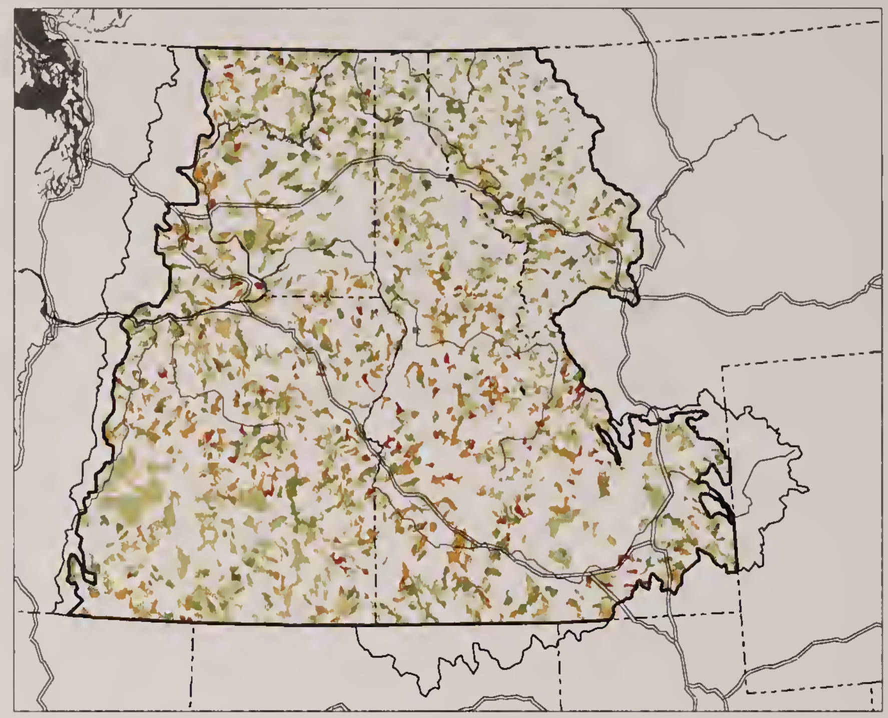
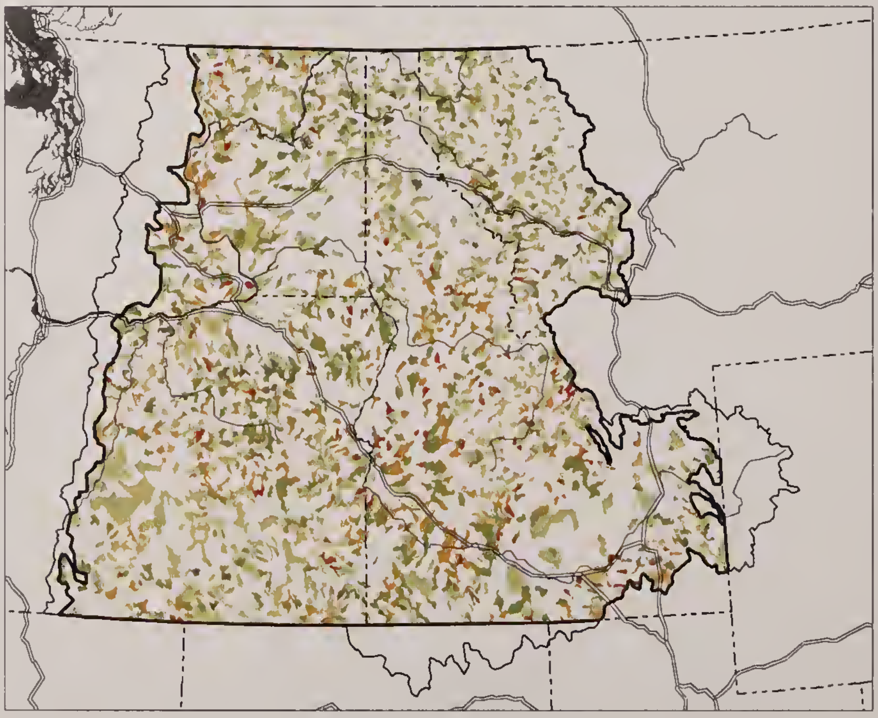


Alternative S1

Alternative S2



Alternative S3

However, much of the Forest Service- and BLM administered forestlands have come to experience uncharacteristic insect and disease activity. Uncharacteristic forest insect and disease activity is defined in the SAG *Effects Analysis* (Quigley 1999) as a change of more than 20 percent from the historical range of forest insect and disease conditions.

In the long term, there would be little difference among the alternatives in the extent of associated uncharacteristic insect and disease activity the project area is expected to experience (Map 4-6). Alternative S2 would be slightly better than Alternative S1, which would be slightly better than Alternative S3. The greatest increases are expected in central and north Idaho, western Montana, and the Cascades. Much of the uncharacteristic insect and disease activity is expected to be in wilderness areas. Uncharacteristic insect and disease activity may decline slightly in the Deschutes RAC and the Butte PAC. The greatest reductions would be in the accessible low elevation dry forests.

In high restoration priority subbasins, Alternatives S2 and S3 are expected to show only slight improvement in uncharacteristic insect and disease activity over Alternative S1. Alternatives S2 and S3 would probably hold the uncharacteristic insect and disease activity levels to slightly more than current levels compared to a modest increase under Alternative S1. Differences among the alternatives would result from a higher concentration of restoration activities in Alternatives S2 and S3, which would regulate stand densities and reduce moisture stress.

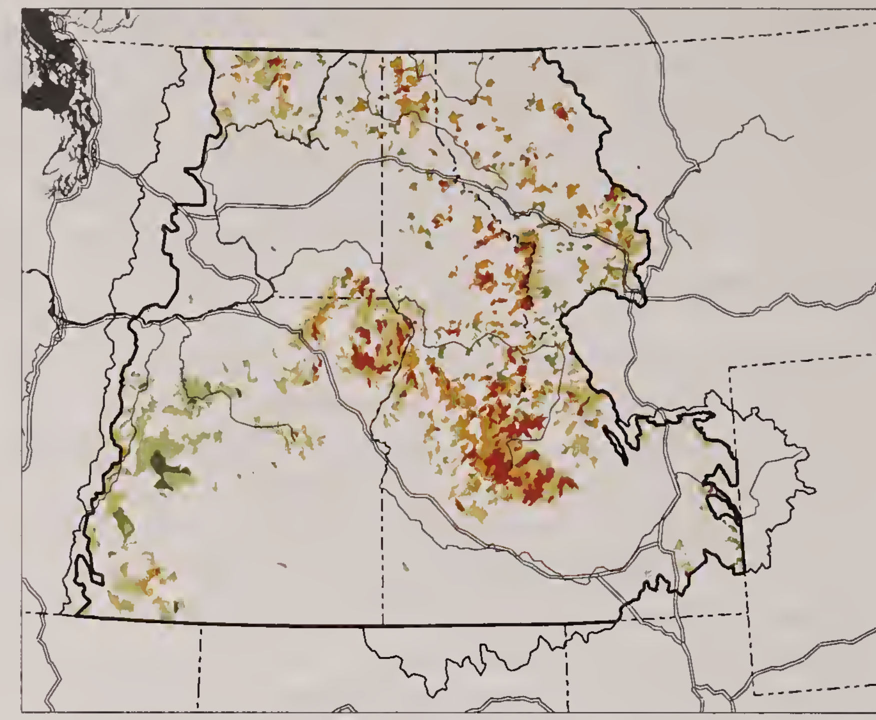
Human Disturbance

Timber harvest is a human-caused disturbance in forestlands. Traditional timber harvest has led to declines in old forests, shade-intolerant species, large trees, and snags and downed wood, all important elements for wildlife species. Alternative S1 would continue some of the same methods of timber harvest into the future. Alternatives S2 and S3 would increase the amount of thinning and timber harvest, but it would be a stewardship harvest. Stewardship harvest would focus on the ecological condition of the forest (outcomes), while traditional harvest has often focused on supplying timber (outputs). Stewardship harvest would promote desired outcomes for species composition and structure, and disturbances more characteristic of the site (such as shade-intolerant trees, large trees, snags, and downed wood). See the socio-economic section of this chapter for a more in-depth comparison of harvest and thinning levels by alternative. Traditional timber harvest and stewardship harvest are defined in the Key Terms at the beginning of this chapter, and in the Glossary.

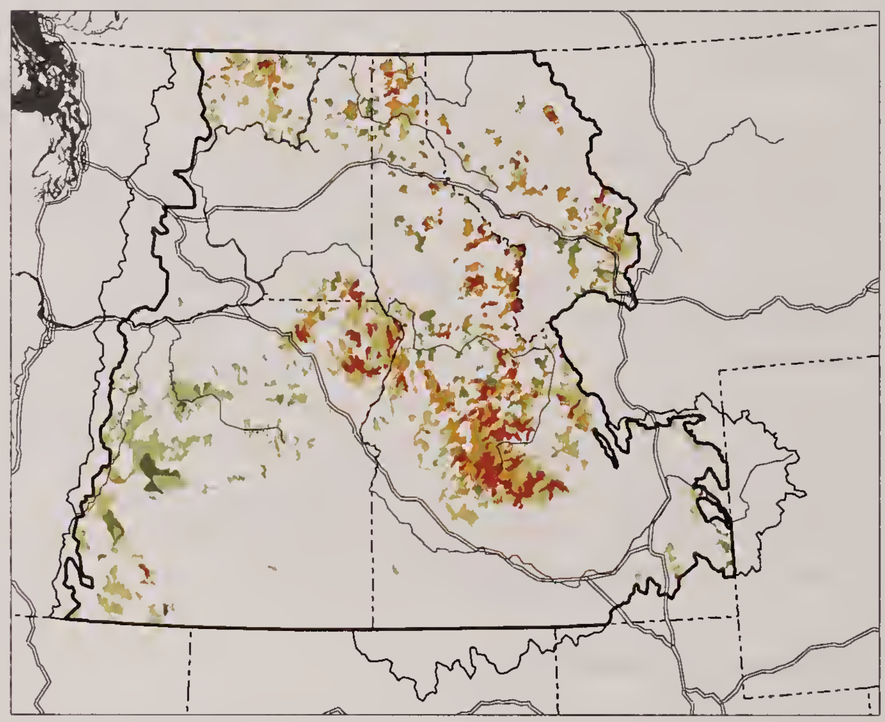
The term 'downed wood' as used in this analysis is synonymous with the term 'coarse woody debris' as used in Chapters 2 and 3. *Large snags* and *large downed wood* are defined in this analysis as dead trees larger than 21 inches in diameter at breast height. Overall, all three alternatives should increase the number of large snags on Forest Service- and BLM-administered lands, with Alternatives S2 and S3 resulting in higher numbers than Alternative S1. In the dry forest PVG, Alternatives S2 and S3 should result in snag numbers slightly above current levels. Alternative S1 is expected to fall short of current numbers. These increases are attributable to aging forests (all alternatives), mortality from insects and disease, expected restoration efforts (Alternatives S2 and S3), and large snag requirements (Alternatives S2 and S3, and to a lesser extent, Alternative S1). All alternatives are expected to increase the large snag levels to slightly above historical levels in the cold forest PVG, and well above historical levels in the moist forest PVG. Some of the greatest increases are expected in the riparian woodland PVG because of the riparian buffers in all alternatives.

Overall, current levels of large downed wood are high. Generally, large downed wood levels on Forest Service- and BLM-administered lands are expected to drop below current levels in Alternatives S2 and S3 because of increases in prescribed fire. Under Alternative S1 the large downed wood levels should continue to increase. In the moist forest PVG, Alternative S1 would maintain the high levels of large downed wood, while Alternatives S2 and S3 would reduce those levels. In the dry forest PVG, all alternatives are expected to increase levels above current and historical, with Alternatives S2 and S3 higher than Alternative S1. There are few expected differences among alternatives in the cold forest PVG.

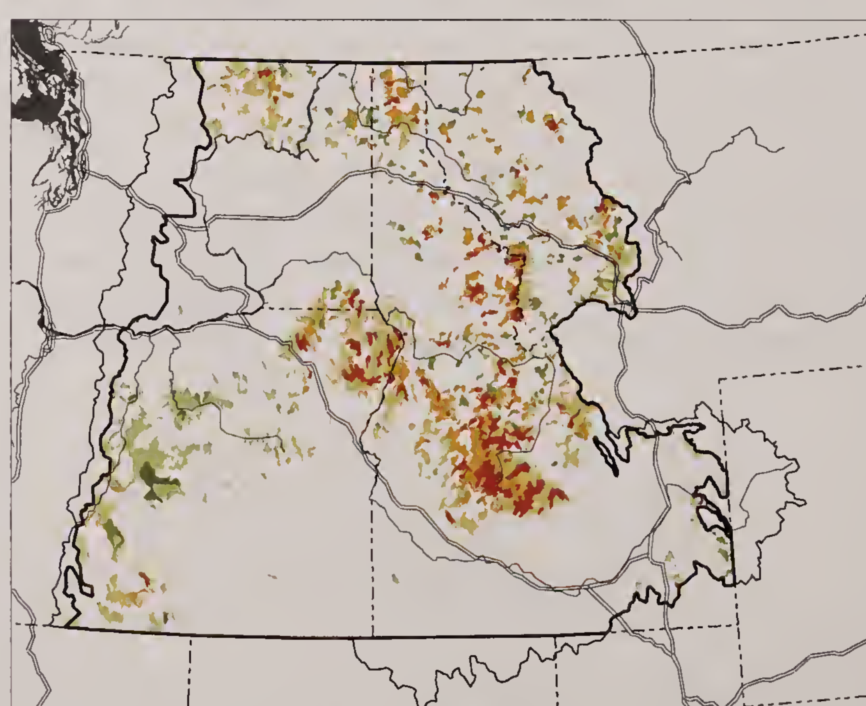
Map 4-6. Uncharacteristic Insect/Disease Tree Mortality Vulnerability Classes: Change from Current



Alternative S1



Alternative S2



Alternative S3

- Low to High
- Moderate to High
- Low to Moderate
- High to Low
- High to Moderate
- Moderate to Low
- No Change
- Major Rivers
- Major Roads
- Supplemental Draft EIS Area Border

INTERIOR COLUMBIA BASIN ECOSYSTEM MANAGEMENT PROJECT

Supplemental Draft EIS Area
2000

Potential Vegetation Groups

Effects of the Alternatives on Potential Vegetation Groups

Introduction

Just looking at species composition and structure, as discussed in the previous section, over simplifies the effects of the alternatives on the landscape. This section provides more detail on how effective the alternatives would be at restoring the diverse mixture of vegetation types across the project area. Understanding the effects of the alternatives on these diverse habitats is important to an understanding of effects on terestrial species, biodiversity, and landscape health.

Following Alpine PVG, the effects section for each *forest* potential vegetation group (PVG) (cold forest, moist forest, dry forest) starts out with a comparison ("Summary Effects") of how well the alternatives are expected to restore the PVG, especially addressing the issues presented in the background discussion for that PVG. The effects of the alternatives on the forested terrestrial communities of the PVG are presented next. Effects for each terrestrial community are described by:

1. A background description of the terrestrial community including current status;
2. The effects of the alternatives on the terrestrial community extent in the long term;
3. The effects of the alternatives on the extent of vegetation types that have declined substantially in geographical extent from historical to current periods, and on vegetation types that have not declined substantially, within the terrestrial community in the long term, if applicable;
4. The effects of the alternatives within T watersheds and high restoration priority subbasins in the long term; and
5. Where the terrestrial communities of the future will come from and/or transition to in the long term.

The effects discussion for each forested PVG ends with a table that displays how effective each alternative is expected to be at trending toward ecologically desired levels of individual terrestrial communities within the PVG.

The effects section for each *rangeland* PVG (woodland, cool shrub, dry grass, dry shrub) also starts out with a background discussion and Summary Effects comparison of how well the alternatives are expected to restore the PVG. However, effects on terrestrial communities in rangeland PVGs are presented in a different format from effects on terrestrial communities in forested PVGs, in part because many of the rangeland terrestrial communities would be expected to incur similar effects in more than one PVG. Additionally, compared to effects in forested PVGs and terrestrial communities (which are complicated by shade tolerance/ intolerance and single/multi-story considerations), the effects within rangeland PVGs are relatively straightforward. Therefore, effects on rangeland terrestrial communities are organized by terrestrial community, following the individual PVG discussions.

Alpine PVG

The alpine PVG makes up a very small part of the project area, and the extent did not change from historical to current periods. It is composed of a single cover type, the alpine tundra, which is divided into two structural stages: the closed low shrub and the open low shrub. The extents of these structural stages are somewhat evenly divided.

The alpine PVG is not expected to change much over the next 100 years because in the high elevation cold climate, vegetation changes from natural succession or disturbance come very slowly and none of the alternatives have priorities or management activities directed at the alpine PVG.

Cold Forest PVG

Background

From historical to current periods, the cold forest has seen the fewest changes of any of the forest PVGs. However, some of the major changes include a shift in dominance from shade-intolerant to shade-tolerant species, loss of whitebark pine due to blister rust, and an increase in the early seral vegetation types. The predominant fire regime has changed from mixed severity and infrequent, to stand-replacing and very infrequent.

Summary Effects for Cold Forest

Under Alternatives S2 and S3, a lower emphasis has been placed on restoration activities in the cold forest

PVG compared to other forest PVGs, because the shifts in vegetation and disturbance regimes have not been as great, much of the cold forest lacks accessibility, and the vegetation would be slower to show successional changes or to respond to restoration activities in the cooler, high elevation environments in the future than other forest PVGs.

Alternatives S2 and S3 (with little difference between them) would be expected to be more effective at slowing undesirable trends than Alternative S1. Beneficial effects under all alternatives, however, would be constrained by the lower concentration of restoration activities in the cold forest PVG compared to other forested PVGs, the relative slow growth of vegetation, and the fact that the cold forest PVG contains much of the wilderness areas and A1 subwatersheds (in Alternatives S2 and S3) where restoration is limited.

Basin-wide on Forest Service- and BLM-administered lands, all alternatives are expected to increase the extent of whitebark pine, with Alternatives S2 and S3 higher than Alternative S1. Most of that increase would come in the early seral structural stage, at the expense of old forests which would decline in the long term under all alternatives because of white pine blister rust.

The whitebark pine/subalpine larch cover type is relatively small in size compared to other cover types in the project area. However, it is very important both ecologically and because of its drastic decline. Overall, all alternatives would increase the extent of the whitebark pine/subalpine larch cover type on Forest Service- andBLM-administered lands in the long term.

Alternatives S2 and S3 are expected to show improvement in T watersheds and high restoration priority subbasins by bringing the whitebark pine/subalpine larch and whitebark pine vegetation types that have declined substantially in geographical extent from historical to current periods back to historical levels. Under Alternative S1 the extent of these vegetation types would continue to decline in these same areas.

When all cold forest cover types are considered, all of the alternatives are expected to reduce the extent of early seral forests to near historical levels, with Alternatives S2 and S3 coming closer than Alternative S1. Alternatives S2 and S3 should also come the closest to the ecologically desirable mix on the landscape of vegetation types that have and have not declined substantially in geographical extent from historical to current periods.

Based on HRV departure data, the landscape disturbance regimes would continue to move away from historical regimes in the long term on Forest Service- and BLM-administered lands basin-wide. This would result from continued succession and less frequent disturbance regimes than historical, leading to changes in vegetation and less landscape diversity in patch and pattern. Alternatives S2 and S3 should slow HRV departure more than Alternative S1. Alternatives S2 and S3 should slow HRV departure even more in the high restoration priority subbasins because of the increased emphasis on restoration and a higher concentration of restoration activities in those areas.

Effects on Cold Forest Terrestrial Communities

Early Seral Montane (Cold Forest PVG)

Background: This terrestrial community consists of stand-initiation and shrub/herb/tree regeneration. Lodgepole pine in the stand-initiation structural stage is the only vegetation type that has declined substantially in geographic extent from historical to current periods. The most extensive vegetation types that have not declined substantially are interior Douglas-fir and shrub/herb/tree regeneration. This terrestrial community is currently at greater than historical levels.

Future Extent: In the long term, all alternatives are expected to maintain near current levels of the early seral montane forest. The lack of difference among the alternatives is due to the relatively low priority for restoration activities in the cold forest.

Specified Areas: However, in T watersheds and high restoration priority subbasins, Alternatives S2 and S3 are expected to increase the extent of the vegetation type that has declined substantially in geographic extent from historical to current periods (lodgepole pine stand-initiation) and reduce the extent of the vegetation types that have not declined substantially (interior Douglas-fir and shrub/ herb/tree regeneration) more than Alternative S1.

Future transitions: Stand-replacing disturbance would be the agent that shifts late seral and mid seral montane forests into the early seral montane terrestrial community. As these early seral montane forest grow, they would shift to the mid seral montane terrestrial community.

Early Seral Subalpine (Cold Forest PVG)

Background: This terrestrial community group is made up of the stand-initiation structural stage in just a few cover types. The vegetation types that have

declined substantially in geographic extent from historical to current periods are in the whitebark pine and the whitebark pine/alpine larch cover types. Cover types that have not declined substantially are the Engelmann spruce/ subalpine fir and mountain hemlock. Engelmann spruce/ subalpine fir and whitebark pine are the major cover types in this terrestrial community. The extent of this terrestrial community is above historical levels.

Future Extent: All of the alternatives should reduce the extent of this terrestrial community, toward historical in the long term on Forest Service- and BLM-administered lands. Alternatives S2 and S3 are expected to decrease the extent the most compared to Alternative S1.

Alternatives S2 and S3 are expected to increase the extent of vegetation types that have declined substantially in geographic extent from historical to current periods (whitebark pine stand-initiation stage) more than Alternative S1, especially in T watersheds and high restoration priority subbasins. Alternatives S2 and S3 should also increase the extent of vegetation types that have declined substantially in geographic extent from historical to current periods and reduce the extent of the vegetation types that have not declined substantially (Engelmann spruce/subalpine fir stand-initiation stage) to closer to historical levels in these areas of interest.

Future Transitions: Most of this terrestrial community would be created through stand-replacing wildfire in all alternatives because of the increasing fire levels (Alternative S1 and to a lesser extent, Alternatives S2 and S3) and the relatively low priority for restoration in the high elevation forests (Alternatives S2 and S3 and to a lesser extent, Alternative S1). Also, much of this terrestrial community is within wilderness area boundaries, which limits the use of active management.

Stand-replacing disturbance would be the agent that shifts late seral and mid seral subalpine forests into the early seral subalpine terrestrial community. As these early seral subalpine forests grow, they would shift to the mid seral subalpine terrestrial community.

Mid Seral Montane (Cold Forest PVG)

Background: The mid seral montane forest is composed of young to middle-aged structural stages and three cover types in various combinations. The shade-intolerant species is lodgepole pine. The shade-tolerant species are interior Douglas-fir and red fir. There is one vegetation type that has declined substantially in geographic extent from historical to current periods: interior Douglas-fir stem exclusion closed canopy. This terrestrial community has declined in extent.

Future Extent: In the long term on Forest Service- and BLM-administered lands, all alternatives would increase the extent of the mid seral montane terrestrial community to near historical amounts.

Overall, Alternative S2 is expected to increase the most the extent of the vegetation type that has declined substantially in geographic extent from historical to current periods (interior Douglas-fir stem exclusion closed canopy) and increase the least the extent of the vegetation types that have not declined substantially. This would lead to closer to historical levels of vegetation types that have declined substantially and those that have not declined substantially. Alternative S1 is the furthest from historical ranges, and Alternative S3 is slightly less than Alternative S2.

Specified Areas: In T watersheds and high restoration priority subbasins, Alternatives S2 and S3 should do a better job of increasing the vegetation types that have declined substantially in geographic extent from historical to current periods and decreasing the vegetation types that have not declined substantially compared to Alternative S1. This is because of the higher priority for and higher concentration of restoration activities in these areas of concern.

Future Transitions: The expansion of the mid seral montane forest in the cold forest PVG would come through growth and succession from the early seral montane terrestrial community. The loss of this terrestrial communtity in some places would most likely be due to growth and succession to late seral montane multi- and single story forests, or conversion through stand-replacing disturbance such as wildfire, insects, and disease (all alternatives) to early seral montane forests.

Mid Seral Subalpine (Cold Forest PVG)

Background: The mid seral subalpine terrestrial community contains several young to middle-aged structural stages of the whitebark pine, whitebark pine/alpine larch, mountain hemlock, and Engelmann spruce cover types. Most of the whitebark pine and whitebark pine/alpine larch structural stages have declined substantially in geographic extent from historical to current periods. All but one of the Engelmann spruce structural stages have not declined substantially, and mountain hemlock is a minor type in the project area. The extent of this terrestrial community has not changed much.

Future Extent: All alternatives are projected to see a decline in the extent of the mid seral subalpine forest on Forest Service- and BLM-administered lands in the long term. The level would go below historical levels in Alternatives S2 and S3 because the high elevation cold forests are a relatively low priority for restoration activities and active management. Also, much of this terrestrial community is in designated wilderness area, where active management is limited.

Specified Areas: In T watersheds outside wilderness areas, and in high restoration priority subbasins, Alternatives S2 and S3 are expected to increase vegetation types that have declined substantially in geographic extent from historical to current periods while decreasing vegetation types that have not declined substantially more than Alternative S1. Because of increased emphasis on and a slightly higher concentration of restoration activities in high restoration priority subbasins, Alternatives S2 and S3 would come the closest to historical proportions.

Future transitions: The mid seral subalpine forests would grow and mature into late seral subalpine multi- and single story forests through the process of succession (all alternatives). Mid seral subalpine forests would develop from early seral subalpine forests through normal growth and succession, and from late seral subalpine forests through disturbances such traditional timber harvest (Alternative S1), and insects and disease (all alternatives), that would cause mortality in the older trees.

Late Seral Montane Multi-story (Cold Forest PVG)

Background: The late seral montane multi-story terrestrial community includes the late seral multi-story structural stage of four different cover types. None of the vegetation types in this terrestrial community have declined substantially in geographic extent from historical to current periods. The most prominent vegetation types are interior Douglas-fir, lodgepole pine, and grand fir/white fir. The trend from historical to current in this terrestrial community is a slight increase.

Future Extent: In the long term on Forest Service- and BLM-administered lands, all alternatives would maintain near current levels of late seral montane multi-story forest.

Specified Areas: In the T watersheds and high restoration priority subbasins, Alternatives S2 and S3 would maintain late seral montane multi-story vegetation types near current levels. However, Alternative S1 is expected to increase vegetation types beyond historical ranges. Alternative S2 would come the closest to reaching historical proportions. Alternative S3 would result in proportions slightly worse than Alternative S2 but better than Alternative S1.

Future transitions: The late seral montane multi-story terrestrial community would come from mid seral montane forests through growth and succession (all alternatives) and, in the absence of disturbance, from development of multiple canopy layers in late seral montane single story forests. Transitions out of this terrestrial community would go to early seral montane montane forests through disturbances such as traditional harvest, wildfire, insects (all alternatives), and disease (all alternatives).

Late Seral Montane Single Story (Cold Forest PVG)

Background: This is a relatively small terrestrial community compared to other terrestrial communities within the cold forest PVG. Lodgepole pine, late seral single story stage, is the only vegetation type within this terrestrial community that has declined substantially in geographic extent from historical to current periods. Of the vegetation types that have not declined substantially, interior Douglas-fir, and western redcedar/western hemlock (also late seral single story stage), are the predominant ones. Therefore, these are the three vegetation types driving the differences between the alternatives in this terrestrial community. The late seral montane single story forest has declined since historical times.

Future Extent: All of the alternatives are expected to increase the extent of this terrestrial community on Forest Service- and BLM-administered lands in the long term but all would still be at less than historical levels.

Alternative S2 would come closest to historical levels in extent of the vegetation type that has declined substantially in geographic extent from historical to current periods, followed by Alternative S3, with Alternative S1 last. Alternative S1 is expected to reduce vegetation types that have not declined substantially far below historical levels, followed by Alternative S3, and Alternative S2. The result is that basin-wide, Alternative S2 would be more effective at matching the levels of the vegetation types in this terrestrial community to historical amounts, with Alternative S3 next and Alternative S1 last.

Specified Areas: In T watersheds and high restoration priority subbasins, Alternative S2 would be most effective in increasing the vegetation type that has declined substantially in geographic extent from historical to current periods and reducing the vegetation types that have not declined substantially, followed by Alternative S3 and Alternative S1. Late seral single story lodgepole pine would be increased,

especially in Alternatives S2 and S3, while the late seral single story interior Douglas-fir is expected to decline in extent, resulting in beneficial trends.

Future transitions: Transitions into this terrestrial community would come from the mid seral montane forest through growth and succession (all alternatives), and from late seral montane single story forests through restoration activities such as thinning and prescribed fire (Alternatives S2 and S3). Transitions out of this terrestrial community would be: to early seral forests through stand-replacing disturbances such as wildfire (all alternatives) and traditional harvest (Alternative S1); to mid seral montane forests through disturbances such as traditional harvest (Alternative S1) or insects and disease (all alternatives); or to late seral montane multi-story forests through growth and succession (all alternatives).

Late Seral Subalpine Multi-story (Cold Forest PVG)

Background: The late seral subalpine multi-story terrestrial community is composed of four species in the late seral multi-story structural stage. All of the vegetation types in this terrestrial community have declined substantially in geographic extent from historical to current periods, including: whitebark pine, whitebark pine/alpine larch, Engelmann spruce/subalpine fir, and mountain hemlock (a minor type).

Future Extent: All of the alternatives would increase this terrestrial community above current levels. Alternatives S2 and S3 are expected to increase the extent of this terrestrial community to within historical levels, while Alternative S1 would not.

Specified Areas: The results should be similar in T watersheds and high restoration priority subbasins, where Alternatives S2 and S3 achieve historical ranges. However, these gains are not expected to come in the whitebark pine cover type. Most gains would instead come in whitebark pine/alpine larch and especially the Engelmann spruce/subalpine fir late seral multi-story forests.

Future transitions: Transitions into this terrestrial community would come from the mid seral subalpine terrestrial community through growth and succession (all alternatives) and from late seral subalpine single story forests through successional development of multiple canopy layers in the absence of disturbance (all alternatives). Transitions out of this terrestrial community would be to early seral subalpine forests through stand-replacing disturbance such as wildfire, insects and disease (all alternatives); or to mid seral montane forest through lesser disturbance such as traditional timber harvest (Alternative S1) or white pine blister rust (all alternatives).

Late Seral Subalpine Single Story (Cold Forest PVG)

Background: The late seral subalpine single story terrestrial community is almost exclusively made up of whitebark pine in the late seral single story structure. This is vegetation type has not declined substantially in geographic extent from historical to current periods. This terrestrial community has expanded since historical times.

Future Extent: In the long-term, basin-wide on Forest Service- and BLM-administered lands, all alternatives are expected to reduce the extent of this vegetation type to well below historical levels. This decline can be attributed to white pine blister rust (all alternatives) and the lack of priority for restoration (Alternatives S2, S3, and to a lesser extent Alternative S1) in the late seral subalpine single story terrestrial community, much of which can be found in designated wilderness areas where active restoration is limited.

Specified Areas: In T watersheds the effects would likely be similar to basin-wide projections because it would require very active management to prevent the decline. In high restoration priority subbasins, Alternatives S2 and S3 would increase the amount of the old single story whitebark pine cover type even more because of the additional emphasis and funding intended for the high restoration priority subbasins. This would be encouraging, but there is uncertainty in the effective development of blister rust resistant planting stock.

Future transitions: Transitions into this terrestrial community would come from the mid seral subalpine terrestrial community through growth and succession (all alternatives), and from the late seral multi-story forests through restoration activities such as thinning (Alternatives S2 and S3) and prescribed fire (Alternatives S2 and S3). Transitions away from this terrestrial community would go to early seral montane forest through stand-replacing disturbance (all alternatives), or to mid seral montane forest through lesser disturbance such as traditional timber harvest (Alternative S1) or white pine blister rust (all alternatives).

Table 4-12 summarizes effects of the alternatives on the cold forest PVG.

Table 4-12. Effects of the Alternatives on the Cold Forest Potential Vegetation Group (PVG) in the Project Area,[1] Current to Long Term.

Terrestrial Community Group	Trend Toward (T) or Away (A) From Historical Amounts (Short Term/Long Term) Alternative S1	Alternative S2	Alternative S3	Alternative that Comes Nearest to Trending Terrestrial Communities Toward Historical
Early seral montane	T/T	T/T	T/T	S2
Early seral subalpine	T/T	T/T	T/T	S1=S2=S3
Mid seral montane	T/A	T/T	T/T	S2=S3
Mid seral subalpine	A/A	A/A	A/A	S2=S3
Late seral montane multi-story	A/A	A/A	A/A	S2
Late seral subalpine multi-story	T/A	T/T	T/T	S2=S3
Late seral montane single story	A/A	A/A	A/A	S2
Late seral subalpine single story	A/A	A/A	A/A	S2=S3

[1] Project Area = Forest Service- or BLM-administered lands in the project area.

Source: Interpreted from ICBEMP GIS data.

Moist Forest PVG

Background

Because of fire suppression, timber harvest, roads, and white pine blister rust, the moist forest PVG has experienced great change since settlement of the project area by Euroamericans. Vast amounts of old forest have converted to mid seral stages. Early forest stages have declined. Only five percent of the western white pine cover type remains. Shade-intolerant species such as western white pine, western larch, and ponderosa pine have often been replaced by shade-tolerant species including interior Douglas-fir and grand fir/white fir. These changes in tree species and the stress from increased stand densities have led to uncharacteristic effects from insects and disease. The predominant fire regime has changed from mixed severity frequent and infrequent fires, to lethal stand-replacing infrequent and very infrequent fire.

Summary Effects for Moist Forest

A higher emphasis has been placed in Alternatives S2 and S3 on restoration activities in the moist forest PVG compared to the cold forest PVGs, because of large shifts in vegetation and disturbance regimes, scarcity of some terrestrial habitats, accessibility, and the rapid pace at which succession takes place in moist forest. This emphasis should lead to a higher concentration of restoration activities compared to the cold forest PVG but a slightly lower concentration of activities than in the dry forest PVG.

Alternatives S2 and S3 would be expected to be more effective in slowing the undesired trends in the moist forest PVG than Alternative S1. Alternative S2 should do slightly better than Alternative S3 because restoration activities would be concentrated in fewer high restoration priority subbasins, but even in Alternative S2 restoration activities would not be extensive or intensive enough to reverse the rapid successional changes that occur in the moist forests.

Alternatives S2 and S3 would increase the extent of old forests in the moist forest PVG in the long term to slightly above historical levels. Old forest in the moist forest PVG in Alternative S1 would not achieve historical levels. All alternatives would hold early seral forests near current levels, with Alternative S1 closer to historical than Alternatives S2 and S3.

Alternatives S2 and S3 are expected to increase the extent of the white pine species to slightly below the historical range, much above the extent expected for Alternative S1 over the long term. Other shade-intolerant species such as western larch and ponderosa pine also would increase under all alternatives but would be closer to historical levels under Alternatives S2 and S3. Uncharacteristic effects from insects and disease should continue near current levels under all alternatives with little difference between the alternatives.

The landscape disturbance regimes would continue to become less like historical regimes in the long term on Forest Service- and BLM-administered lands basin-wide. Alternatives S2 and S3 would not allow

this departure from HRV to increase as much as Alternative S1. There would be even greater differences between alternatives in the high restoration priority subbasins; Alternatives S2 and S3, by focusing restoration activities to these areas of high risk and opportunity, would concentrate efforts to address landscape disturbance regimes; Alternative S1 does not have this basin-wide strategy.

Effects on Moist Forest Terrestrial Communities

Early Seral Lower Montane (Moist Forest PVG)

Background: The early seral lower montane forest covers a relatively small portion of the moist forest PVG. It is made up of only two species/ structural stage combinations, and both have declined substantially in geographic extent from historical to current periods: interior ponderosa pine and Pacific ponderosa pine, both in the stand-initiation stage of early seral forest. Pacific ponderosa pine is a minor type, leaving interior ponderosa pine stand-initiation as the vegetation type that drives this terrestrial community. The early seral lower montane forest has decreased in extent in the moist forest PVG.

Future Extent: Basin-wide, all alternatives would increase the interior ponderosa pine stand-initiation vegetation type to above historical levels on Forest Service- and BLM- administered lands. Alternative S1 is expected to increase the extent the most, followed by Alternative S3, with Alternative S2 closest to historical levels.

Since interior ponderosa pine stand-initiation is the driver in this terrestrial community, increasing its extent would increase presence of the main vegetation type that has declined substantially in geographic extent from historical to current periods in this terrestrial community.

Specified areas: In T watersheds, all alternatives are expected to increase extent of the interior ponderosa pine stand-initiation stage to near historical levels. In the high restoration priority subbasins of Alternatives S2 and S3, the extent of intererior ponderosa pine stand-initiation stage would be similar to that found project area-wide for all alternatives.

Future transitions: The transitions into this community would be mainly from mid and late seral stages of lower montane and montane forests through stand-replacing wildfire (all alternatives) and other severe disturbances (all alternatives), clearcuts (Alternative S1), and conversion from vegetation types inappropriate for the site through restoration (Alternatives S2 and S3). Transitions could go to mid seral lower montane forests such as young multi-story (managed or unmanaged) through growth and succession (all alternatives), or to shrub/herb/tree regeneration through stand replacing disturbance (all alternatives).

Early Seral Montane (Moist Forest PVG)

Background: Historically, the early seral montane terrestrial community accounted for one-fourth of the moist forest PVG. It is almost entirely made up of the stand-initiation structural stage with a variety of species. There are two main species that have declined substantially in geographic extent from historical to current periods: western larch and western white pine. The early seral montane terrestrial community also contains significant amounts of interior Douglas-fir and grand fir/white fir in the moist forest, which have not declined substantially in geographic extent from historical to current periods. The extent of the early seral montane forest has decreased since the historical period.

Future Extent: All of the alternatives are expected to maintain current extent of this terrestrial community with little difference between alternatives.

Alternatives S2 and S3 would increase the extent of vegetation types that have declined substantially in geographic extent from historical to current periods (western larch and western white pine) more than Alternative S1. Interior Douglas-fir and grand fir/ white fir, which have not declined substantially, would remain near current extent or slightly below for all alternatives.

Specified areas: In T watersheds, all alternatives should slightly increase the extent of vegetation types that have declined substantially in geographic extent from historical to current periods, with Alternative S2 more than Alternative S3 and Alternative S1. In high restoration priority subbasins, Alternative S1 is expected to increase the extent of vegetation types that have declined substantially in geographic extent from historical to current periods more than Alternatives S2 and S3. The main reason for these differences would be more stand-replacing wildfire under Alternative S1, which would create more early seral forest than under Alternatives S2 and S3.

Future transitions: The vegetation types that have not declined substantially would be created in this terrestrial community through stand-replacing wildfire (Alternative S1 more than Alternatives S2 and S3), clearcutting (Alternative S1), and other stand-replacing disturbances (all alternatives). The vegetation types that have declined substantially in geographic extent from historical to current periods would be increased through intentional creation of

openings to establish western larch and western white pine (Alternatives S2, S3, and to a lesser extent, S1). Transitions out of the early seral montane forest would likely be to mid seral montane forest through growth and succession (all alternatives).

Early Seral Subalpine (Moist Forest PVG)

Background: A small amount of early seral subalpine terrestrial community overlaps with the moist forest PVG. The species are Engelmann spruce/subalpine fir and mountain hemlock, of which mountain hemlock is a very small amount. Therefore, Engelmann spruce in the stand-initiation stage, which has not declined substantially in geographic extent from historical to current periods, is the only substantial vegetation type. The early seral subalpine terrestrial community has slightly decreased in extent.

FutureExtent: All alternatives are projected to reduce the extent of this terrestrial community in the moist forest PVG on Forest Service and BLM administered lands in the long term, with little difference among alternatives, primarily because of low priority for restoration and slow growth and succession in these cool environments (all alternatives).

Future transitions: Forests transitioning into this terrestrial community would come from mid and late seral subalpine forests through stand-replacing disturbances such as wildfire, insects, and disease (all alternatives). The early seral subalpine terrestrial community would mature into mid seral subalpine forests through succession and growth (all alternatives).

Mid Seral Lower Montane (Moist Forest PVG)

Background: The vegetation types in the mid seral lower montane terrestrial community that have declined substantially in geographic extent from historical to current periods are Pacific ponderosa pine (stem exclusion closed canopy stage), a minor type, and interior ponderosa pine (stem exclusion closed canopy stage), which is the dominant type. The important vegetation types that have not declined substantially are all interior ponderosa pine: (1) understory reinitiation, (2) stem exclusion open canopy, (3) young multi-story unmanaged, and (4) young multi-story managed. Although the young multi-story managed vegetation type is important today, it did not exist historically. The mid seral lower montane forest has increased slightly in extent.

Future Extent: All alternatives would increase the extent of this terrestrial community above current levels on Forest Service- and BLM- administered lands in the long term.

It is projected that all alternatives would increase the extent of the vegetation type that has declined substantially in extent from historical to current periods (interior ponderosa pine stem exclusion closed canopy) but would fall short of historical levels. All alternatives are expected to maintain the extent of vegetation types that have not declined substantially near current levels with little difference among alternatives.

Specified areas: In T watersheds, Alternative S2 would return closest to historical levels the extent of vegetation types that have declined substantially in geographic extent from historical to current periods. The extent under Alternative S3 would be slightly less, followed by Alternative S1. In high restoration priority subbasins, Alternatives S2 and S3 would increase the extent of these vegetation types the nearest to historical and higher than Alternative S1.

Future transitions: Stand-replacing disturbances such as wildfire (all alternatives) could transition this terrestrial community back to an early seral lower montane terrestrial community. Other disturbances such as insects and disease (all alternatives), or traditional timber harvest (Alternative S1) could transition this terrestrial community to a mid seral montane forest by converting the ponderosa pine to a shade-tolerant cover type. Growth and succession (all alternatives) would transition these forests into late seral lower montane multi- or single story terrestrial communities (all alternatives).

New mid seral lower montane forest would come from the early seral lower montane forest through growth and succession (all alternatives) . They may also transition from late seral forests through disturbances such as insects and disease (all alternatives), or timber harvest (Alternative S1) that removes the larger trees.

Mid Seral Montane (Moist Forest PVG)

Background: At present, the mid seral montane terrestrial community accounts for nearly 60 percent of the moist forest PVG. The vegetation types are composed of various combinations of several species and young to middle-age structural stages. There are four vegetation types of consequence that have declined substantially in geographic extent from historical to current periods: western larch (young multi-storied, and unmanaged), western white pine (stem exclusion closed canopy), western white pine (understory reinitiation), and interior Douglas-fir (stem exclusion closed canopy). The important vegetation types that have not declined substantially are combinations of six species (western larch,

western white pine, interior Douglas-fir, grand fir/white fir, western redcedar/western hemlock, and lodgepole pine) and four structural stages (stem exclusion closed canopy, young multi-story unmanaged, young multi-story managed, and understory reinitiation). The mid seral montane terrestrial community has increased in extent.

Future Extent: The mid seral montane terrestrial community is expected to decrease in extent to near historical levels under all alternatives on Forest Service- and BLM- administered lands in the long term.

None of the alternatives would achieve the historical extent of vegetation types that have declined substantially in geographic extent from historical to current periods. Alternative S3 would increase the vegetation types that have not declined substantially from historical to current periods slightly more than Alternative S2, which would be higher than Alternative S1.

Specified areas: In T watersheds and high restoration priority subbasins together, Alternative S3, slightly more than Alternative S2, is expected to increase the extent of vegetation types that have declined substantially in geographic extent from historical to current periods and reduce the extent of vegetation types that have not declined substantially. Both Alternatives S2 and S3 would do a better job than Alternative S1 of adjusting the vegetation types that have and have not declined substantially. In high restoration priority subbasins alone, Alternative S2 would be better at increasing vegetation types that have declined substantially and decreasing vegetation types that have not declined substantially, followed by Alternative S3.

Future transitions: Much of the mid seral montane terrestrial community should transition to the late seral montane multi-story terrestrial community through growth and succession. With restoration activities such as thinning and prescribed fire (especially Alternatives S2 and S3), some would transition to the late seral montane single story terrestrial community. Also, because of stand-replacing disturbance such as wildfire (all alternatives) and clearcuts (Alternative S1), the mid seral montane would be converted to early seral montane forest. Intentionally creating openings to regenerate western larch and western white pine (Alternatives S2 and S3) should also convert the mid seral montane to early seral montane forest.

Mid Seral Subalpine (Moist Forest PVG)

Background: A small amount of mid seral subalpine terrestrial community is found in the moist forest PVG. The main species are Engelmann spruce/subalpine fir and mountain hemlock, of which mountain hemlock is a very small amount. Therefore, Engelmann spruce/subalpine fir in the (1) stem exclusion closed canopy, (2) young multi-story unmanaged, (3)young multi-story managed, and (4) understory reinitiation structural stages are the only substantial vegetation types. None of these vegetation types have declined substantially in geographic extent from historical to current periods. The mid seral subalpine forest has increased substantially in extent.

Future Extent: Alternatives S2 and S3 are expected to reduce the extent of the mid seral subalpine terrestrial community but not to historical on Forest Service- and BLM- administered lands in the long term. Alternative S1 would maintain the extent near current levels.

Specified areas: In T watersheds and high restoration priority subbasins, Alternatives S2 and S3 would reduce the extent of vegetation types that have not declined substantially in geographic extent from historical to current periods more than Alternative S1.

Future transitions: The mid seral subalpine forests would grow and mature into late seral subalpine multi- and single story forests through the process of succession (all alternatives). The mid seral subalpine forests would develop from early seral subalpine forests through normal growth and succession (all alternatives) and from late seral subalpine forests through disturbances such as traditional timber harvest (Alternative S1), and insects and disease (all alternatives) that would cause mortality in the older trees.

Late Seral Lower Montane Multi-story (Moist Forest PVG)

Background: The late seral lower montane multi-story terrestrial community is a very small part of the moist forest PVG. Within the terrestrial community, interior ponderosa pine and Pacific ponderosa pine are the only cover types and late seral multi-story forest is the only structural stage. Interior ponderosa pine late seral multi-story structural stage is by far the most important, although both vegetation types have declined substantially in geographic extent from historical to current periods. The late seral lower montane multi-story terrestrial community has decreased substantially in extent.

Future Extent: The late seral lower montane multi-story terrestrial community is expected to expand in extent under all alternatives. Alternative S1 would increase the extent beyond historical levels, while Alternatives S2 and S3 would be within the historical

range. Alternative S1 would lead to higher amounts of this terrestrial community than Alternatives S2 and S3 because under Alternative S1 much of what should be in the late seral lower montane single story forest would develop multiple layers due to lack of disturbance.

Specified areas: In T watersheds and high restoration priority subbasins, the trends should be similar. Alternative S1 would increase the extent beyond historical levels. Alternative S2 would make the extent of this terrestrial community closest to historical levels. Alternative S3 would result in slightly above historical levels.

Future transitions: The vegetation types that would transition into this terrestrial community would be the late seral lower montane multi-story and mid seral lower montane forests. They would transition through restoration activities that develop single-story characteristics (Alternatives S2 and S3). Mid seral lower montane forest would mature into this terrestrial community through growth and succession (all alternatives). Late-seral lower montane multi-story forest would change to early seral montane forest through stand-replacing disturbance such as wildfire, insects, and disease (all alternatives). Transitions to the mid seral lower montane forests would be caused by less severe disturbances such as traditional timber harvest (Alternative S1) or insects and disease (all alternatives), which cause mortality in the large trees.

Late Seral Montane Multi-story (Moist Forest PVG)

Background: The late seral montane multi-story terrestrial community is composed of several species in the late seral multi-story structural stage. Western larch and western white pine are the two most important vegetation types that have declined substantially in geographic extent from historical to current periods. The important vegetation types that have not declined substantially include interior Douglas-fir, grand fir/white fir, and lodgepole pine. The late seral montane multi-story terrestrial community has decreased substantially in extent since historical times.

Future Extent: All alternatives are expected to increase the extent of late seral montane multi-story forest. The extent in Alternatives S2 and S3 would be near historical levels, while the extent in Alternative S1 would be slightly below historical.

Alternative S2 would increase the most the extent of vegetation types that have declined substantially in geographic extent from historical to current periods, followed closely by Alternative S3. Alternative S1 would produce the least amount of vegetation types that have declined substantially in geographic extent from historical to current periods. None of the alternatives would likely achieve historical extents of vegetation types that have declined substantially basin-wide on Forest Service- and BLM-administered lands in the long-term.

Specified areas: In T watersheds, Alternative S2 would best achieve the historical extent of vegetation types that have declined substantially from historical to current periods, with Alternative S3 close behind. Alternative S1 would result in slightly below historical levels. In high restoration priority subbasins, none of the alternatives are expected to reach the historical range of those vegetation types that have declined substantially in geographic extent from historical to current periods. However, Alternative S2 would likely get closest, with Alternative S3 slightly less and Alternative S1 far behind.

Future transitions: Late seral montane multi-story forests would come from mid seral montane forests and late seral montane single story forests in the absence of disturbance through growth and succession (all alternatives). They would transition to early seral montane forests when stand-replacing disturbances occur, such as wildfire (all alternatives), clearcut harvests (Alternative S1), or regeneration harvest (Alternatives S2 and S3). The structural stage pathway would go to mid seral montane when disturbances such as traditional harvest (Alternative S1) or insects and disease (all alternatives) cause mortality in the large trees.

Late Seral Subalpine Multi-story (Moist Forest PVG)

Background: The late seral subalpine multi-story terrestrial community is made up almost entirely of the Engelmann spruce/ subalpine fir late seral multi-story vegetation type, a vegetation type which has decreased subastantially in extent from historical to current periods.

Future Extent: All alternatives are expected to increase the extent of the Engelmann spruce/ subalpine fir late seral subalpine cover type and thus increase the extent of the terrestrial community far above historical levels on Forest Service- and BLM-administered lands in the long-term. The extent under Alternatives S2 and S3 would be slightly above historical levels for this terrestrial community. The extent under Alternatives S1 would be even higher.

Specified areas: In T watersheds, Alternatives S2 and S3 would maintain the extent of this terrestrial community within historical ranges. Alternative S1 would result in levels above historical. In high restoration priority subbasins, Alternatives S2 and S3 would likely cause the late seral subalpine multi-story forest to increase in extent somewhat above historical levels (but closer to historical than Alternative S1) because of the increased emphasis on restoration and the increased concentration of activities. The extent would go beyond the historical ranges, however, because subalpine types are not a high priority for restoration.

Future transitions: Transitions into the late seral subalpine multi-story forest would come from the mid seral subalpine forest through growth and succession (all alternatives), and from the late seral subalpine single story forest when lack of disturbance allows these forests to develop multiple canopy layers (all alternatives). Transitions out of this terrestrial community would likely be due to stand-replacing wildfire or insects and disease (all alternatives). Timber harvest (Alternative S1) is not common in this vegetation type but could also be a stand-replacing disturbance.

Late Seral Lower Montane Single Story (Moist Forest PVG)

Background: The overwhelming vegetation type in the late seral lower montane single story forest is interior ponderosa pine late seral single story forest. The Pacific ponderosa pine late seral single story forest is also a part of this terrestrial community, but a minor type. Interior ponderosa pine late seral single story forest has declined substantially in geographic extent from historical to current periods, while Pacific ponderosa pine has not declined substantially from historical to current periods. The extent of this terrestrial community has decreased substantially.

Future Extent: All alternatives are expected to increase the extent of the interior ponderosa pine late seral single story forest but not achieve historical levels on Forest Service- and BLM- administered lands in the long-term. Alternatives S2 and S3 would result in higher levels than Alternative S1.

Specified areas: In T watersheds and high restoration priority subbasins, Alternative S2 would increase the extent more than Alternative S3, followed by Alternative S1.

Future transitions: Transitions would come from mid seral lower montane forests and late seral lower montane multi-story forests through restoration activities such as thinning and low intensity burning (Alternatives S2 and S3 and to a lesser extent, Alternative S1). This terrestrial community would transition to early seral lower montane forests through stand-replacing disturbance such as wildfire (all alternatives) or traditional timber harvest (Alternative S1). Other transitions would be to the mid seral lower montane forest where less severe disturbances, such as traditional timber harvest (Alternative S1) or insects and disease (Alternatives S2 and S3) kill the large trees. Also, this terrestrial community would transition to late seral lower montane multi-story through succession and development of additional canopy layers. The late seral lower montane single story forest must be maintained by frequent light disturbances to prevent it from converting to a multi-story terrestrial community.

Late Seral Montane Single Story (Moist Forest PVG)

Background: The late seral montane single story accounts for a very tiny piece of the moist forest PVG. Of the vegetation types that make up the late seral montane single story terrestrial community, western larch and lodgepole pine in the late seral single story stage are the only vegetation types that have declined substantially in geographic extent from historical to current periods. There are five vegetation types that have not declined substantially, but only one existed historically: interior Douglas-fir late seral single story. The others are western white pine, grand fir/white fir, western redcedar/western hemlock, and Sierra Nevada mixed conifer (a very minor cover type). The late seral montane single story forest has increased slightly.

Future Extent: Alternatives S2 and S3 are expected to increase the extent of the late seral montane single story forest to above historical levels on Forest Service- and BLM-administered lands in the long term. Alternative S1 should reduce the extent slightly below current levels.

All alternatives are expected to increase the extent of the vegetation types that have declined substantially in geographic extent from historical to current periods, but short of historical extent. Alternative S2 would result in the greatest extent followed by Alternatives S3, than Alternative S1. Alternatives S2 and S3 are expected to decrease the extent of the vegetation types that not declined substantially to near historical levels. Alternative S1 would reduce the extent of vegetation types that have not declined substantially to below historical levels.

Specified areas: In T watersheds and high restoration priority subbasins, Alternative S2 would bring the extent of vegetation types that have declined substantially in geographic extent from historical to current periods the nearest to historical, with Alternative S3 following closely and Alternative S1 having the least increase in extent.

Future transitions: Some of this terrestrial community would likely go to late seral montane single story forest through restoration activities such as thinning or light burning (Alternatives S2 and S3). Some would likely go to early seral montane forest through stand-replacing wildfire (all alternatives), traditional timber harvest (Alternative S1), or regeneration harvests to create openings for shade-intolerant western larch (Alternatives S2 and S3). Less severe disturbances, such as traditional timber harvest (Alternative S1) and insects or disease (all alternatives), would transition some of this terrestrial community into mid seral montane terrestrial communities. This terrestial community would develop from the maturing mid seral montane forest through growth and succession (all alternatives). It could also come from late seral montane muti-story forest through restoration activities such as thinning and/or light fire (Alternatives S2 and S3).

Late Seral Subalpine Single Story (Moist Forest PVG)

Background: Historically and currently, the late seral subalpine single story forest, which is made up of the Engelmann spruce/subalpine fir and mountain hemlock cover types in the late seral single story structural stage, is insignificant in extent in the project area.

Future Extent: The late seral subalpine single story forest is not expected to change under any alternative in the future.

Table 4-13 summarizes effects of the alternatives on the moist forest PVG.

Dry Forest PVG

Background

The dry forest PVG has seen the most change in stand structure, composition, and fire regime of any forest PVG. One of the foremost changes in the dry forest is the decline in the amount of ponderosa pine, which has been replaced by interior Douglas-fir and grand

Table 4-13. Effects of the Alternatives on the Moist Forest Potential Vegetation Group (PVG) in the Project Area,[1] Current to Long Term.

Terrestrial Community Group	Trend Toward (T) or Away (A) From Historical Amounts or Maintain Current (C) Amounts(Short Term/Long Term) Alternative S1	Alternative S2	Alternative S3	Alternative that Comes Nearest to Trending Terrestrial Communities Toward Historical
Early seral lower montane	T/A	T/A	T/A	S 2
Early seral montane	C/C	C/C	C/C	S2=S3
Early seral subalpine	T/A	T/A	T/A	S1=S2=S3
Mid seral lower montane	A/A	A/A	A/A	S2=S3
Mid seral montane	T/T	T/T	T/T	S3
Mid seral subalpine	T/T	T/T	T/T	S2=S3
Late seral lower montane multi-story	T/A	T/T	T/T	S2
Late seral montane multi-story	A/A	T/T	T/T	S2
Late seral subalpine multi-story	T/A	T/A	T/A	S2=S3
Late seral lower montane single story	T/T	T/T	T/T	S2=S3
Late seral montane single story	A/A	T/A	T/A	S2=S3
Late seral subalpine single story	NA	NA	NA	NA

[1] Project Area = Forest Service- or BLM-administered lands in the project area.

Source: Interpreted from ICBEMP GIS data.

fir/white fir. To a lesser extent, western larch has seen declines as well. Dry forests are often denser today, which leads to increased moisture stress, resulting in greater insect and disease mortality. A notable insect problem in the dry forest is bark beetles.

Higher tree densities, increased fuel levels, and greater continuity of fuels has led to changes in fire regime from historical times in the dry forest PVG. The predominant fire regime has gone from very frequent underburns to a fairly even mix of underburns, lethal stand-replacing, and a mix of lethal and non-lethal fire, burning on an infrequent and very infrequent basis.

Old forests have declined substantially in the dry forest PVG, especially those with single story structure. In general, forests showing the most change are those that have been roaded and harvested. Large trees, snags, and coarse woody debris are all below historical levels in these areas.

Summary Effects for Dry Forest

Under Alternatives S2 and S3, a higher emphasis has been placed on restoration activities in the dry forest PVG compared to other forest PVGs because of large shifts in vegetation and disturbance regimes, scarcity of some terrestrial habitats, accessibility, and fire danger in the urban-rural-wildland interface. This should lead to a higher concentration of restoration activities in the dry forest PVG compared to other forested PVGs.

In general, the old forest is expected to increase over the long term on Forest Service- and BLM-administered lands under all alternatives for the dry forest PVG. Alternatives S2 and S3 would be best at turning around the decline in old forest. These alternatives would increase the extent to within historical ranges, while Alternative S1 would be somewhat less. Much of this increase in old forest would be in the multi-story structural stage, which would be above historical levels for all alternatives, especially Alternative S1. Alternatives S2 and S3 would result in closer to desired levels of old forest multi-story structure.

Alternatives S2 and S3 would better increase the amount of old forest in the single story-structural stage but would not reach historical levels. Alternative S1 would increase old forest single story structure but to a lesser degree than the other two alternatives. The reason for more of this scarce vegetation type in Alternatives S2 and S3 is the increased amount of thinning and prescribed fire under these alternatives compared to Alternative S1. Single story structure requires frequent low intensity disturbances to create and maintain them. Succession, in the absence of disturbance, pushes the dry forest types toward multi-story structure. Alternative S2 would result in a more desirable mix of single story and multi-story on the landscape, followed closely by Alternative S3. Alternative S1 would be last.

The interior ponderosa pine cover type would increase above current levels for all alternatives, to slightly over historical levels. However, Alternatives S2 and S3 would do a better job than Alternative S1 of increasing the structural stages that have declined substantially in geographic extent from historical to current periods, and would put a more desirable mix of the interior ponderosa pine structural stages on the landscape.

Uncharacteristic insect and disease effects would increase slightly in the long term under Alternative S2 and S3, and more under Alternative S1 on Forest Service- and BLM-administered lands in the dry forest PVG. This unwanted trend can be taken as an indication that stand densities and moisture stress would be higher in Alternative S1 than Alternatives S2 and S3 because there would be more thinning, stewardship harvest, and prescribed fire in Alternatives S2 and S3.

Alternatives S2 and S3 are expected to increase the numbers of large snags in the dry forest to above historical levels, considered a positive trend. Alternative S2 would be higher than Alternative S3. These increases are attributable to aging forests, expected restoration efforts, and large snag requirements in the management direction. Alternative S1 is expected to increase the numbers of large snags in the long term because of aging forests, but would fall short of historical levels. Alternatives S2 and S3 would increase the levels of large downed wood to slightly above historical levels in the dry forest. Again, this would be a desirable trend. Alternative S1 would increase large downed wood levels above current but would not achieve historical levels.

Under Alternative S1 the amount of uncharacteristic wildfire is expected to increase in the long term on Forest Service- and BLM-administered lands. Alternatives S2 and S3, on the other hand, would likely see a desirable decrease in the amount of uncharacteristic wildfire from current levels, with Alternative S3 lower than Alternative S2. Much of this decrease would be expected to come in the dry forest PVG because of the emphasis on restoration there. The result would be an increase in thinning and prescribed fire, which leads to reductions in uncharacteristic wildfire effects.

Using HRV departure as an indicator of changes in future disturbance regimes, all alternatives would experience continued deviation of disturbance regimes on Forest Service- and BLM-administered lands in the long term. There would be little difference among alternatives, basin-wide, but Alternatives S2 and S3 should show improvement over Alternative S1 in T watersheds outside of wilderness areas and high restoration priority subbasins.

Effects on Dry Forest Terrestrial Communities

Early Seral Lower Montane (Dry Forest PVG)

Background: Historically, the early seral lower montane terrestrial community accounted for only about five percent of the dry forest PVG; currently it is much less. The vegetation types within the terrestrial community are interior ponderosa pine and Pacific ponderosa pine, both in the stand-initiation stage; both have declined substantially from historical to current periods. However, the Pacific ponderosa pine stand-initiation stage is of minor extent in the project area. In other words, the early seral lower montane terrestrial community is essentially all interior ponderosa pine in the stand-initiation stage. It has declined since historical times.

Future Extent: All alternatives are expected to increase the extent of interior ponderosa pine in the stand-initiation stage to above historical levels on Forest Service- and BLM-administered lands in the long term. Alternatives S2 and S3 are expected to be closer to the historical range than Alternative S1. Much of the expansion of this vegetation type would be the result of large stand-replacing wildfires.

Specified Areas: In T watersheds, all alternatives are expected to increase this vegetation type to near historical levels, with no differences among alternatives. In high restoration priority subbasins, Alternatives S2 and S3 are expected to do a better job of keeping the expansion of the early seral lower montane forest to within historical ranges or slightly above. Alternative S1 would allow this type to move further above historical ranges than is desirable.

Future transitions: Transitions into this terrestrial community would come from mid seral and late seral lower montane forest through stand-replacing disturbances such as wildfire (all alternatives), insects (all alternatives), and traditional timber harvest (Alternative S1). Transitions would come from intentional conversion of some montane cover types such as interior Douglas-fir or grand fir/white fir into interior ponderosa pine (Alternatives S2 and S3). Growth and succession would move this terrestrial community into various mid seral lower montane vegetation types (all alternatives).

Early Seral Montane (Dry Forest PVG)

Background: The early seral montane terrestrial community is almost entirely made up of the stand-initiation structural stage in several cover types. The two main cover types that have declined substantially in geographic extent from historical to current periods are: western larch and lodgepole pine. Early seral montane forest also contains significant amounts of interior Douglas-fir, grand fir/white fir, and shrub/herb/tree regeneration cover types, which have not declined substantially in geographic extent from historical to current periods. This terrestrial community has increased in extent since historical times.

Future Extent: All alternatives would reduce the extent of early seral montane forests on Forest Service- and BLM-administered lands in the long term. There would be little difference among alternatives basin-wide.

Specified Areas: In T watersheds and high restoration priority subbasins, all alternatives would increase the extent but would fall short of historical levels. Alternative S2 would come closest to historical levels, followed by Alternative S3, with Alternative S1 last.

Future transitions: Transitions into this terrestrial community would come from mid seral and late seral montane forest through stand-replacing disturbances such as wildfire, insects, and disease (all alternatives); and traditional timber harvest (Alternative S1). Transitions would also come from intentional conversion of some montane cover types such as interior Douglas-fir or grand fir/white fir (Alternatives S2 and S3) in mid seral and late seral stages to western larch or lodgepole pine. Growth and succession would change this terrestrial community into various mid seral montane vegetation types (all alternatives).

Mid Seral Lower Montane (Dry Forest PVG)

Background: The vegetation types in the mid seral lower montane terrestrial community that have declined substantially in geographic extent from historical to current periods are Pacific ponderosa pine stem exclusion closed canopy stage (a minor type) and interior ponderosa pine stem exclusion closed canopy stage (the dominant type). The vegetation types of note that have not declined substantially are interior ponderosa pine in the following structural stages: understory reinitiation, stem exclusion open canopy, young multi-story unmanaged, and young

multi-story managed. The young multi-story managed stage, presently a fairly extensive stage, did not exist historically. The extent of the terrestrial community as a whole has increased slightly.

Future Extent: Alternatives S2 and S3 would do a good job of maintaining current levels of this terrestrial community on Forest Service- and BLM-administered lands in the long term. Alternative S1 would allow the mid seral montane forest to increase above current levels, not an ecologically desirable trend. Alternative S2 followed by Alternative S3 would get the vegetation types that have declined substantially into the historical range sooner than Alternative S1.

In the long term, Alternatives S2 and S3 are expected to maintain the amounts of vegetation types that have declined substantially to within the historical ranges, while Alternative S1 would allow them to move above desired levels.

Specified Areas: In T watersheds and high restoration priority subbasins, the results should be similar to the basin-wide results: Alternatives S2 and S3 would be better than Alternative S1.

Future transitions: Stand-replacing wildfire or other severe disturbances (all alternatives) could change this terrestrial community back to an early seral lower montane terrestrial community. Other disturbance such as insects (all alternatives), or traditional timber harvest (Alternative S1) could transition this terrestrial community to a mid seral montane forest by converting the ponderosa pine to an interior Douglas-fir or grand fir/white fir cover type. Growth and succession (all alternatives) would move these forests into late seral lower montane multi- or single story terrestrial communities. Restoration activities (Alternatives S2 and S3) could speed up this process and prevent stagnation of mid seral forests.

New mid seral lower montane forest would come from growth and succession (all alternatives) from the early seral lower montane forest. They may also come from late seral forests through disturbances such as insects (all alternatives) or timber harvest (Alternative S1) that remove the larger trees.

Mid Seral Montane (Dry Forest PVG)

Background: At present, the mid seral montane terrestrial community accounts for roughly one-fourth of the dry forest PVG. There are two vegetation types of consequence that have declined substantially in geographic extent from historical to current periods: western larch young multi-story unmanaged, and interior Douglas-fir stem exclusion closed canopy. The important vegetation types that have not declined substantially are combinations of the following cover types: western larch, interior Douglas-fir, grand fir/ white fir; and lodgepole pine; and structural stages: the stem exclusion closed canopy, young multi-story unmanaged, young multi-story managed, and understory reinitiation. This terrestrial community is currently substantially above its historical extent.

Future Extent: All alternatives are expected to successfully reduce the amount of the mid seral montane forest on Forest Service- and BLM-administered lands in the long term to within historical ranges.

Alternatives S2 and S3 would increase the vegetation types that have declined substantially in geographic extent from historical to current periods and would reduce the vegetation types that have not declined substantially more effectively than Alternative S1.

Specified Areas: In T watersheds and high restoration priority subbasins, Alternatives S2 and S3 are expected to reach the historical range of mid seral montane sooner than Alternative S1. In those same places, Alternatives S2 and S3 would increase the extent of the vegetation types that have declined substantially and reduce vegetation types that have not declined substantially better than Alternative S1.

Future transitions: Loss in extent of the mid seral montane forest would be due to transitions to late seral montane multi- and single story forests through growth and succession (all alternatives). Other changes into early seral montane forest would be from stand-replacing disturbance such as wildfire (all alternatives), traditional timber harvest (Alternative S1), or silvicultural activities to intentionally create openings for western larch regeneration (Alternatives S2 and S3). Transitions into mid seral montane forest would be from early seral montane forest because of growth and succession (all alternatives) or from late seral montane multi-story forests through disturbances such as traditional timber harvest (Alternative S1) or insects and disease (all alternatives), which remove the large trees.

Late Seral Lower Montane Multi-story (Dry Forest PVG)

Background: The late seral lower montane multi-story terrestrial community contains interior ponderosa pine and Pacific ponderosa pine in the late seral multi-story forest structural stage. Interior ponderosa pine late seral multi-story structural stage is by far the most important vegetation type because it accounts for 99 percent of the terrestrial community,

although both have declined substantially in geographic extent from historical to current periods. This terrestrial community has not changed in extent much since historical times.

Future Extent: Alternatives S2 and S3 would maintain near current levels of this terrestrial community, within the historical range on Forest Service- and BLM-administered lands in the long term. Alternative S1 would allow the interior ponderosa pine in the late seral multi-story structural stage to move above the historical extent. Alternatives S2 and S3 would also move the mix of vegetation types that have and have not declined substantially close to historical. Alternative S1 would be somewhat behind the other alternatives.

Specified Areas: In T watersheds and high restoration priority subbasins, Alternatives S2 and S3 would increase the extent of the interior ponderosa pine late seral multi-story structural stage to near historical levels. Alternative S1 would go beyond desired levels.

Future transitions: This terrestrial community would expand as growth and succession pushes mid seral lower montane into this type (all alternatives). Stand-replacing disturbance would change some of these forests to early seral montane forest (all alternatives); less severe disturbances, such as traditional timber harvest (Alternative S1) or insects (all alternatives), which cause mortality in the larger trees, would cause transitions to the mid seral lower montane forests.

Late Seral Montane Multi-story (Dry Forest PVG)

Background: The late seral montane multi-story terrestrial community is composed of four cover types in the late seral multi-story structural stage. Western larch is the only species that has declined substantially in geographic extent from historical to current periods. The important vegetation types that have not declined substantially include interior Douglas-fir, grand fir/white fir, and lodgepole pine. The late seral montane multi-story terrestrial community has increased substantially in the dry forest PVG since historical times, just the opposite of what this terrestrial community has done in the moist forest PVG.

Future Extent: Basin-wide on Forest Service- and BLM-administered lands, all alternatives are expected to reduce the extent of the late seral montane multi-story terrestrial community, but none would likely reach the historical range in the long term. Alternative S2 would come the closest to historical levels. Alternative S3 would be next best, followed by Alternative S1.

Alternatives S2 and S3 would be the most effective alternatives at increasing vegetation types that have declined substantially in geographic extent from historical to current periods and at decreasing vegetation types that have not declined substantially.

Specified Areas: In T watersheds, Alternatives S2 and S3 are expected to increase to historical levels the vegetation types that have declined substantially, sooner than Alternative S1. In high restoration priority subbasins, Alternatives S2 and S3 are expected to increase these vegetation types more than Alternative S1 but short of historical levels.

Future transitions: Late seral montane multi-story forests would come from mid seral montane forests and late seral montane single story forests in the absence of disturbance through the forces of succession. They would transition to early seral montane forests when overstory trees are removed by stand-replacing disturbances such as wildfire (all alternatives), clearcutting (Alternative S1), or regeneration harvest (Alternatives S2 and S3). The transition would go to mid seral montane if disturbances such as traditional harvest (Alternative S1) or insects and disease (all alternatives) remove the large trees.

Late Seral Lower Montane Single Story (Dry Forest PVG)

Background: The most extensive vegetation type in this terrestrial community is the interior ponderosa pine late seral single story forest, which has declined substantially in geographic extent from historical to current periods. The Pacific ponderosa pine late seral single story forest, which has not declined substantially, is also a part of this terrestrial community, but a minor type. The interior ponderosa pine late seral lower montane forest has declined by 80 percent.

Future Extent: Although none of the alternatives would reach historical levels, they all are expected to increase the late seral lower montane single story forest. Alternative S2 would produce the highest amounts of this terrestrial community, Alternative S3 would be next, and Alternative S1 would be a distant third.

Specified Areas: In T watersheds and high restoration priority subbasins, the results would be similar with the same relative rank among the alternatives: Alternative S2 best, Alternative S3 next, and Alternative S1 last.

Future transitions: Transitions into the late seral lower montane single story forest would come from mid seral lower montane forests through growth and

succession (all alternatives) and late seral lower montane multi-story forests through restoration activities such as thinning and low intensity burning (Alternatives S2 and S3 and to a lesser extent, Alternative S1). Transitions out of this terrestrial community would go to early seral lower montane forests through stand-replacing disturbance such as wildfire (all alternatives) or traditional timber harvest (Alternative S1). Other transitions would be to the mid seral lower montane forest, where disturbances such as traditional timber harvest (Alternative S1) or insects (all alternatives) would cause mortality in the large trees. Also, this terrestrial community would transition to late seral lower montane multi-story through succession and development of additional canopy layers (all alternatives). The late seral lower montane single story forest must be maintained by frequent light disturbances to prevent it from converting to a multi-story terrestrial community.

Late Seral Montane Single Story (Dry Forest PVG)

Background: The late seral montane single story accounts for a small piece of the dry forest PVG. Western larch and lodgepole pine in the late seral single story stage are the only vegetation types that have declined substantially in geographic extent from historical to current periods. There are two vegetation types that have not declined substantially, but only one existed historically: interior Douglas-fir late seral single story. The other is grand fir/white fir. This terrestrial community has increased slightly since historical times.

Future Extent: Alternatives S2 and S3 are expected to reduce the extent of the late seral montane single story forest to historical levels. Alternative S1 should reduce the amount well below historical levels.

Specified Areas: In T watersheds, Alternative S2 would reach historical levels sooner than Alternative S3, followed by Alternative S1. In high restoration priority subbasins, Alternative S2 would bring levels of vegetation types that have declined substantially in geographic extent from historical to current periods the nearest to historical levels, with Alternative S3 close behind, and Alternative S1 last.

Future transitions: Some of this terrestrial community would likely go to early seral montane forest through stand-replacing disturbance such as wildfire (all alternatives), traditional timber harvest (Alternative S1), or regeneration harvests to create openings for western larch or lodgepole pine (Alternatives S2 and S3). Less severe disturbances such as traditional timber harvest (Alternative S1), insects, or disease (all alternatives), would transition some of this terrestrial community into mid seral montane terrestrial communities. The late seral montane single story forest would come from the mid seral montane forest through growth and succession (all alternatives). It would also come from late seral montane multi-story forest through restoration activities such as thinning and light fire (Alternatives S2 and S3).

Table 4-14 summarizes effects of the alternatives on the dry forest PVG.

Table 4-14. Effects of the Alternatives on the Dry Forest Potential Vegetation Group (PVG) in the Project Area,[1] Current to Long Term.

Terrestrial Community Group	Trend Toward (T) or Away (A) From Historical Amounts (Short Term/Long Term) Alternative S1	Alternative S2	Alternative S3	Alternative that Comes Nearest to Trending Terrestrial Communities Toward Historical
Early seral lower montane	T/A	T/A	T/A	S2=S3
Early seral montane	T/T	T/T	T/T	S2
Mid seral montane	A/A	T/T	T/T	S2=S3
Mid seral lower montane	T/T	T/T	T/T	S2=S3
Late seral lower montane multi-story	A/A	T/T	T/T	S2=S3
Late seral montane multi-story	T/T	T/T	T/T	S2
Late seral lower montane single story	T/T	T/T	T/T	S2
Late seral montane single story	T/T	T/T	T/T	S2

[1] Project Area = Forest Service- or BLM-administered lands in the project area.

Source: Interpreted from ICBEMP GIS data.

Woodland PVG

Background

From historical to current periods the dominant change within the woodland PVG was the encroachment of woodlands and shrublands into what was formerly herblands. This conversion of herblands to woodlands and shrublands, although not covering much area within the woodland PVG, contributed to the widespread decline in the project area of the wheatgrass bunchgrass and fescue-bunchgrass, two herbland vegetation types that have declined greatly from historical to current in the project area at current. Currently the woodland PVG is dominated by woodlands and shrublands, and noxious weeds and exotic undesirable plants are not common.

Summary Effects for Woodland PVG

In the long term, herblands would increase in extent at the expense of woodlands and shrublands under all alternatives. Herblands would increase more, and woodlands and shrublands would decline more, in Alternatives S2 and S3 than in Alternative S1. The effects of Alternatives S2 and S3 would be similar for the woodland PVG. Although noxious weeds and exotic undesirable plants would increase in extent under all alternatives, they would expand less in Alternatives S2 and S3 than in Alternative S1. While none of the alternatives would result, over the long term, in the extent of herblands, woodlands, shrublands, and noxious weeds and exotic undesirable plants estimated to have been present at historical within the woodland PVG, Alternatives S2 and S3 would come the closest to achieving historical levels for the vegetation types combined.

Cool Shrub PVG

Background

From historical to current the dominant change within the cool shrub PVG was the encroachment of woodlands into what was formerly herblands and/or shrublands. This conversion of herblands and shrublands to woodlands within the cool shrub PVG contributed to the widespread decline in the project area of the wheatgrass bunchgrass, fescue-bunchgrass, mountain big sagebrush, and big sagebrush, vegetation types that have declined substantially in geographic extent from historical to current periods in the project area. Western juniper, a native tree of the Pacific Northwest, has expanded greatly and is primarily responsible for the woodland expansion.

Summary Effects for Cool Shrub PVG

In the long term, the extent of woodlands would decrease, shrublands and herblands would increase, and noxious weeds and exotic undesirable plants would decrease, under all alternatives. Woodlands would decrease more, shrublands and herblands would increase more, in Alternatives S2 and S3 than in Alternative S1, with only slight differences between Alternatives S2 and S3. Although noxious weeds and exotic undesirable plants would increase in extent under all alternatives, they would expand less in Alternatives S2 and S3 than in Alternative S1. While none of the alternatives would result over the long term in the extent of woodlands, shrublands, herblands, and noxious weeds and exotic undesirable plants estimated to have been present historically within the cool shrub PVG, Alternatives S2 and S3 come the closest to achieving historical amounts for the vegetation types combined.

Dry Grass PVG

Background

The dominant change within the dry grass PVG was the conversion of herblands to noxious weeds and exotic undesirable plants. This conversion of herblands to noxious weeds and exotic undesirable plants within the dry grass PVG contributed to the widespread decline in the project area of wheatgrass bunchgrass and fescue-bunchgrass, which have declined substantially in geographic extent from historical to current periods.

Summary Effects for Dry Grass PVG

Over the long term, herblands would continue to decrease in extent while noxious weeds and exotic undesirable plants would increase in extent, under all alternatives. Although noxious weeds and exotic undesirable plants would increase in extent under all alternatives, they would expand less in Alternatives S2 and S3 than in Alternative S1. Therefore, herblands would decline less in Alternatives S2 and S3 than in Alternative S1.

Dry Shrub PVG

Background

From historical to current periods the dominant changes within the dry shrub PVG were the conversion of herblands and shrublands to noxious weeds

and exotic undesirable plants, and the conversion of herblands to shrublands. These conversions within the dry shrub PVG contributed to the widespread decline in the project area of the wheatgrass bunchgrass, fescue-bunchgrass, big sagebrush, and antelope bitterbrush-bluebunch wheatgrass, vegetation types that have declined substantially in geographic extent from historical to current periods. Cheatgrass, an exotic undesirable plant, has expanded greatly and is primarily responsible for the decline in herblands and shrublands.

Summary Effects for Dry Shrub PVG

Over the long term, the extent of shrublands would decrease, herblands would increase, and noxious weeds and exotic undesirable plants would increase, under all alternatives. In Alternatives S2 and S3, shrublands would decrease less, herblands would increase less, and noxious weeds and exotic undesirable plants would increase less, than in Alternative S1, with only slight differences between Alternatives S2 and S3. Shrubland decrease would be attributable to wildfire, which will create upland herbland that is characterized by native bunchgrasses with a substantial component of exotic undesirable plants such as cheatgrass, medusahead, and mustards, which will vary in abundance. Some lesser amounts of upland herbland will be seedings of shrubs, grasses, and forbs as a result of fire rehabilitation efforts in what once was upland shrubland previous to the wildfire. Shorter intervals between wildfires caused by increased flammability from the exotic undesirable plants will retard shrub establishment and retard conversion of upland herblands to upland shrublands. Fire pre-suppression (for example, greenstripping) would be more effective in Alternatives S2 and S3 than in Alternative S1, and this would reduce the amount of shrubland that experiences wildfire. Noxious weeds and exotic undesirable plants would increase in extent, particularly in areas that have not been seeded in the past and probably would not be seeded in the future. Noxious weeds and exotic undesirable plants would expand less and dominate less acreage in Alternatives S2 and S3 than in Alternative S1.

Rangeland PVG Terrestrial Communities

Vegetation Changes Within Upland Woodlands

As described in the previous section on PVGs, the upland woodland terrestrial community within the woodland PVG and the cool shrub PVG would trend toward historical amounts and would decrease in extent under all alternatives from current to long term, with Alternatives S2 and S3 trending slightly more toward historical (decreasing in extent) than Alternative S1. This is notable because from historical to current periods, upland woodlands in these two PVGs increased in extent and were trending away from historical.

The main driver in the desired decline in upland woodlands would be a decline in extent of juniper-sagebrush, particularly in the cool shrub PVG. All alternatives (Alternatives S2 and S3 more so than Alternative S1) would achieve some control of western juniper, a native tree of the Pacific Northwest, which expanded greatly between historical and current periods and was primarily responsible for the woodland expansion.

The greater reduction of woodlands in the cool shrub PVG achieved by Alternatives S2 and S3 would be most apparent in the high restoration priority subbasins. Alternative S2 would achieve greater reduction of woodlands within the high restoration priority subbasins than Alternative S3 would do (Table 4-15), because of the greater concentration of restoration activity. Outside of the high restoration priority subbasins, all alternatives would reduce the woodland terrestrial community in the woodland and cool shrub PVGs to a similar degree.

Table 4-15 shows trends in extent from current to long term for upland woodlands within the woodland and cool shrub PVGs. Trends are reported for the high restoration priority subbasins and in the project area, for each alternative on BLM- and Forest Service-administered lands, as related to historical amounts.

Vegetation Changes Within Upland Shrublands

As described in the previous section on PVGs, upland shrublands within the woodland PVG and the cool shrub PVG would trend toward historical amounts between current and long-term. Upland shrublands would decrease in extent in the woodland PVG, and would increase in extent in the cool shrub PVG, under all alternatives in the long term, with Alternatives S2 and S3 trending slightly more toward historical in this regard than Alternative S1. This is notable because from historical to current, upland shrublands in these two PVGs were trending away from historical, increasing in extent in the Woodland PVG and decreasing in extent in the Cool Shrub PVG.

Conversely, within the dry shrub PVG, upland shrublands would trend away from historical amounts over the long term. Upland shrublands

Table 4-15. Effects of the Alternatives on Upland Woodlands within Woodland and Cool Shrub Potential Vegetation Groups (PVGs) in the Project Area,[1] Current to Long Term.

	Trend Toward (T), or Away (A) from Historical Amounts			Alternative That Comes Nearest to Trending Upland Woodlands Toward Historical
	Alternative S1	Alternative S2	Alternative S3	
Project Area	T	T	T	S2=S3
High Restoration Priority Subbasins in Alternative S2	T	T	T	S2
High Restoration Priority Subbasins in Alternative S3	T	T	T	S2

[1] Project Area = Forest Service- or BLM-administered lands in the project area.

Source: Interpreted from ICBEMP GIS data; Hemstrom et al. 1999.

would decrease in extent under all alternatives, with Alternatives S2 and S3 showing less decrease than Alternative S1. This decline in upland shrublands under all alternatives continues the declining trend estimated for historical to current periods.

The main driver in the decline in upland shrublands in the woodland PVG under all alternatives is a decline in extent of closed stands of mountain big sagebrush. Conversion of mountain big sagebrush to upland herblands is attributable to fire. The extent of this vegetation change in total acreage is minor.

The drivers in the increase in upland shrublands in the cool shrub PVG under all alternatives are an increase in extent of mountain big sagebrush, and to a lesser degree, an increase in big sagebrush, both of which have declined substantially in geographic extent from historical to current periods. These trends, to a large degree, would be attributable to the reduction of upland woodlands and more specifically, western juniper, achieved by the alternatives. The greater increase in upland shrublands in the cool shrub PVG that would be achieved by Alternatives S2 and S3 would be most apparent in the high restoration priority subbasins. Within the high restoration priority subbasins, Alternative S2 would achieve slightly greater increase in upland shrublands than Alternative S3 would do (Table 4-16). There would be a greater concentration of restoration activity under Alternative S2, which translates into more acres treated per subbasin than Alternative S3. Outside of the high restoration priority subbasins, all alternatives would increase upland shrublands in the cool shrub PVG, more similarly than in the high restoration priority subbasins.

The driver in the decrease in upland shrublands in the dry shrub PVG would be a decrease in extent of big sagebrush, which has declined substantially in geographic extent from historical to current periods, and a concurrent increase in extent of upland herblands, composed primarily of wheatgrass bunchgrass, which has declined substantially in geographic extent from historical to current periods. Because of fine, herbaceous, flammable fuels such as cheatgrass (an exotic undesirable plant that is ubiquitous but varies in abundance within the dry shrub PVG), upland shrublands would continue to be susceptible to wildfire. Most upland shrublands that burn would convert to upland herblands that are composed of native bunchgrasses, with presence of exotic undesirable plants such as cheatgrass, medusahead, and mustards. These upland herblands would be susceptible to recurring wildfires because of the addition of flammable fine fuels attributable to the exotic plants. Recurring wildfires would retard shrub establishment and increase the proportion of exotic undesirable plants within the upland herblands. A relatively lesser amount of upland shrublands that burn would convert to upland herblands through rehabilitation by seedings that are composed of mixtures of exotic desirable grasses and forbs, and native grasses, shrubs, and forbs.

The lesser decline in upland shrublands in the dry shrub PVG that would be achieved by Alternatives S2 and S3 would be most apparent in the high restoration priority subbasins, where the decline in upland shrublands would be arrested and there would be an increase in extent over the long term. Within the high restoration priority subbasins, Alternative S2 would increase upland shrublands slightly more than

Table 4-16. Effects of the Alternatives on Upland Shrublands within Woodland, Cool Shrub, and Dry Shrub Potential Vegetation Groups (PVGs) in the Project Area,[1] Current to Long Term.

	Trend Toward (T), or Away (A) from Historical Amounts			Alternative That Comes Nearest to Trending Upland Shrublands Toward Historical
	Alternative S1	Alternative S2	Alternative S3	
Upland Shrublands within Woodland and Cool Shrub PVGs				
Project Area	T	T	T	S2=S3
High Restoration Priority Subbasins in Alternative S2	T	T	T	S2
High Restoration Priority Subbasins in Alternative S3	T	T	T	S2
Upland Shrublands within Dry Shrub PVG				
Project Area	A	A	A	S2=S3
High Restoration Priority Subbasins in Alternative S2	T	T	T	S2
High Restoration Priority Subbasins in Alternative S3	T	T	T	S2

[1] Project Area = Forest Service- or BLM-administered lands in the project area.

Source: Interpreted from ICBEMP GIS data; Hemstrom et al. 1999.

Alternative S3 would do (Table 4-16). There would be a greater concentration of restoration activity, including: (1) wildfire suppression activities, such as greenstripping; (2) seedings (which will in most cases contain some shrubs in the mixture); and (3) changes in livestock grazing management—which collectively translate into more acres treated per subbasin and a greater increase in upland shrublands under Alternative S2 for the high restoration priority subbasins than under Alternative S3. Outside of the high restoration priority subbasins, the decline in upland shrublands would continue, similarly among the alternatives.

Table 4-16 shows trends in extent from current to long term for upland shrublands within the woodland, cool shrub, and dry shrub PVGs. Trends are reported for the high restoration priority subbasins and in the project area, for each alternative on BLM- and Forest Service-administered lands, as related to historical amounts.

Vegetation Changes Within Upland Herblands

As described in the previous section on PVGs, upland herblands within the woodland PVG and the cool shrub PVG would trend toward historical amounts and would increase in extent over the long term. The increase is apparent under all alternatives, with Alternatives S2 and S3 showing slightly more improvement in this regard than Alternative S1 within both woodland and cool shrub PVGs. This is notable because from historical to current periods, upland herblands in these two PVGs were trending away from historical, decreasing in extent.

Conversely, within the dry grass and dry shrub PVGs, upland herblands would trend away from historical amounts over the long term. Upland herblands would decrease in extent within the dry grass PVG under all alternatives, with Alternatives S2 and S3 showing less decrease than Alternative S1. Upland herblands would increase in extent within the dry shrub PVG under all alternatives, with Alternatives S2 and S3 showing less increase than S1.

The main driver in the desired increase in upland herblands in the woodland PVG under all alternatives is an increase in wheatgrass bunchgrass, which has declined substantially in geographic extent from historical to current periods. Although notable and attributable to fire converting woodlands to herblands, the extent of this change in acreage is relatively minor.

The main driver in the desired increase in upland herblands in the cool shrub PVG under all alternatives is an increase in the wheatgrass bunchgrass and fescue-bunchgrass cover types, which have declined substantially in geographic extent from historical to

current periods. These trends, to a large degree, would be attributable to the reduction of upland woodlands and more specifically, western juniper, that would be achieved by the alternatives. The greater increase in upland herblands in the cool shrub PVG under Alternatives S2 and S3 would be most apparent in high restoration priority subbasins. Within the high restoration priority subbasins, Alternative S2 would achieve a greater increase in upland herblands than Alternative S3 would do (Table 4-17). There would be a greater concentration of restoration activity, which translates into more acres treated per subbasin, under Alternative S2 for the high restoration priority subbasins compared to Alternative S3. Outside the high restoration priority subbasins, there would be less distinction among the alternatives, as all alternatives would increase upland herblands similarly.

The main driver in the decrease in upland herblands in the dry grass PVG under all alternatives would be an increase in noxious weeds and exotic undesirable plants. Some notable noxious weeds and/or exotic undesirable plants characteristic of the dry grass PVG that would increase in extent are yellow starthistle, spotted knapweed, dalmatian toadflax, and cheatgrass. The lesser decline in upland herblands in the dry grass PVG achieved by Alternatives S2 and S3 would be most apparent in the high restoration priority subbasins. Within the high restoration priority subbasins, Alternative S2 would arrest the decline to a slightly greater extent than would Alternative S3 (Table 4-17). There is a greater concentration of restoration activity, which translates into more acres treated per subbasin, under Alternative S2 for the high restoration priority subbasins compared to Alternative S3. Outside the high restoration priority subbasins, there would be less distinction among the alternatives, as upland herblands would decline similarly under all alternatives.

The main driver in the increase in upland herblands in the dry shrub PVG under all alternatives would be an increase in wheatgrass bunchgrass, which has declined substantially in geographic extent from historical to current periods. The lesser increase in upland herblands in the dry shrub PVG that would be achieved by Alternatives S2 and S3 is most apparent in the high restoration priority subbasins. Within the high restoration priority subbasins, Alternative S2 would achieve slightly less increase than Alternative S3 and would trend upland herblands nearest to historical (Table 4-17).

The reasons explaining the lesser increase of herblands in Alternative S2 originate in the greater concentration of restoration activity in Alternative S2, which includes: (1) wildfire pre-suppression activities, such as greenstripping (which would help reduce the amount of shrubland that converts to herbland); (2) seedings (which will in most cases

Table 4-17. Effects on Upland Herblands within Woodland, Cool Shrub, Dry Grass, and Dry Shrub Potential Vegetation Groups (PVGs) in the Project Area,[1] Current to Long Term.

	Trend Toward (T), or Away (A) from Historical Amounts			Alternative That Comes Nearest to Trending Upland Herblands Toward Historical
	Alternative S1	Alternative S2	Alternative S3	
	Upland Herblands within Woodland and Cool Shrub PVGs			
Project Area	T	T	T	S2=S3
High Restoration Priority Subbasins in Alternative S2	T	T	T	S2
High Restoration Priority Subbasins in Alternative S3	T	T	T	S2
	Upland Herblands within Dry Grassand Dry Shrub PVGs			
Project Area	A	A	A	S2=S3
High Restoration Priority Subbasins in Alternative S2	A	A	A	S2
High Restoration Priority Subbasins in Alternative S3	A	A	A	S2

[1] Project Area = Forest Service- or BLM-administered lands in the project area.

Source: Interpreted from ICBEMP GIS data; Hemstrom et al. 1999.

contain some shrubs in the mixture and would be expected to develop into shrublands); and (3) changes in livestock grazing management that would reduce grazing pressure on the native herbaceous species and slow down the rate of expansion and increasing density of exotic annual species such as cheatgrass, thereby reducing the spread and increase in flammable fine fuels and retarding wildfire's conversion of shrublands to herblands. Collectively, these would translate into more acres treated per subbasin and a greater increase in upland shrublands and a concomitant lesser increase in upland herblands, under Alternative S2 for the high restoration priority subbasins compared to Alternative S3. Outside of the high restoration priority subbasins, the increase in upland herblands would continue, similarly among the alternatives.

Although an increase in upland herblands within the dry shrub PVG seems beneficial because it reflects an increase in the wheatgrass bunchgrass cover type (which has declined substantially in geographic extent from historical to current periods), the increase in upland herblands exceeds the land area that was in upland herblands historically. The increase in upland herblands and wheatgrass bunchgrass is due to both native bunchgrasses and seedings of exotic desirable grasses such as crested wheatgrass. In addition, exotic undesirable plants such as cheatgrass, medusahead, and mustards would be present in varying amounts within the upland herblands and also within upland shrublands, increasing flammable fine fuels and increasing wildfire incidence. While the increase in the native component of upland herblands is desirable (especially for such terrestrial vertebrates as sage grouse and Columbian sharp-tailed grouse in Terrestrial Families 11 and 12), the increase in exotic seedings and exotic undesirable plants is comparatively less desirable. As mentioned previously, Alternative S2 would achieve the most effective prevention of these undesirable characteristics of upland herblands within the dry shrub PVG.

Table 4-17 shows trends in extent from current to long term for upland herblands within the woodland, cool shrub, dry grass, and dry shrub PVGs. Trends are reported for the high restoration priority subbasins and the project area, for each alternative on BLM- and Forest Service-administered lands, as related to historical amounts.

Terrestrial Species Component

This section presents the effects of the alternatives on terrestrial species and their habitats, including plants, terrestrial invertebrates, broad-scale terrestrial vertebrates, terrestrial riparian and wetland species, and special status terrestrial species (threatened, endangered, proposed, or sensitive). The EIS Team used information provided by the Science Advisory Group (SAG) to develop this chapter. The EIS Team also developed additional analyses (for example, to identify habitats that have declined substantially from historical, to determine the likelihood of persistence, and to estimate effects of the alternatives on invertebrates). A summary of key effects and conclusions for all subject areas is presented first. Each subject area then presents methods for estimating effects, and effects of the alternatives. This section concludes with a discussion of hunting, viewing, and collecting considerations.

Summary of Key Effects and Conclusions

In general, Alternative S2 would result in better conditions for terrestrial vertebrates on BLM- and Forest Service-administered lands than Alternative S3, followed by Alternative S1. Differences among alternatives would be smaller when looking at all lands because of the higher proportion of human effects on private ownerships. Relative to the differences among alternatives, most of the species in the following groups would see improved conditions compared to current conditions: old-forest species, riparian species, and species that use habitats that have declined substantially in geographic extent from historical to current periods. Conditions for rangeland species are expected to be stable or declining because of a lack of restoration technology and available resources for active restoration. Within high restoration priority subbasins, the differences among alternatives would be greater. In the long term, passive management would have adverse effects on some terrestrial species. Because the land area within the project area is finite, management actions to benefit one species could harm another.

Plants

- Plant species in all major plant groups would remain stable in their likelihood of persistence under Alternatives S2 and S3 relative to current conditions. In contrast, plant species in all major plant groups would have a reduced likelihood of persistence under Alternative S1 relative to current conditions.
- All alternatives would promote development and maintenance of biological crusts. Alternatives S2 and S3 would provide more restoration focus on biological crusts than Alternative S1.

Terrestrial Invertebrates

- Alternatives S2 and S3 should provide more general benefits to invertebrates than would Alternative S1.

Broad-scale Terrestrial Vertebrates

- Generally, for broad-scale terrestrial vertebrates, there are not substantial differences among the alternatives.
- Number of areas with a high or low environmenal index for terrestrial vertebrate species dependent on old-forest conditions would generally increase from current levels under all alternatives, sometimes approaching historical levels.
- Number of areas with a high or low environmental index for terrestrial vertebrate rangeland species typically would be reduced under all alternatives. Areas with high habitat capacity would be further reduced from current levels.
- Environmental index scores among species would be about 10 to 15 percent higher on Forest Service- or BLM-administered lands compared to all lands under all alternatives.

Terrestrial Riparian and Wetland Species

- For riparian- or wetland-dependent terrestrial vertebrates, Alternative S2 would provide general improved results compared to Alternatives S3, which would have slightly improved results compared to Alternative S1.

Special Status Terrestrial Species

- Management of ecosystems is more effective at maintaining a diverse array of species compared to management for single species. For example,

most vertebrate Terrestrial Families have at least one species with reduced habitat capability, so an action to benefit one species could adversely affect another species.

- Broad-scale threatened and endangered species (woodland caribou, gray wolf, and grizzly bear) would trend toward recovery within recovery areas, but basin-wide conditions would remain greatly reduced from historical for gray wolf and grizzly bear.
- Generally, passive management would have adverse effects on species in a variety of environments. A high degree of departure of vegetation from historical range of variability (HRV) was judged to be adverse for many species. The number of acres with a high level of HRV departure would increase considerably more in wilderness and wilderness-like areas than elsewhere.

Plants

Methodology: How Effects on Plants were Estimated

The assessment of effects of Supplemental Draft EIS on plants of concern was based on qualitative judgments from the Science Advisory Group. Judgments were made relative to the current known distribution and condition of plants of widespread or range-wide concern within the project area from current conditions to 100 years, based on the effectiveness of the management direction in the Supplemental Draft EIS. This effects analysis was not based on habitat persistence. There are 333 plant species in the basin which are of highest concern. For analysis purposes these 333 plants were grouped into nine major plant groups. Judgments of effects on the nine major plant groups were made by placing effects into two categories: decreasing likelihood of persistence relative to current period, and stable likelihood of persistence relative to current period.

The effects of the management alternatives on biological crusts were compiled using a combination of several sources. These sources included Johnson and Kingery (1999), which provided a qualitative evaluation of the effects of the management alternatives on biological crusts, and trends for livestock grazing effects and exotic undesirable plants interpreted from SAG data.

Effects of the Alternatives on Plants

Generally non-vascular plants and vascular plants of concern are affected the most by local conditions. Even broadly distributed non-vascular and vascular species are often limited to specific habitats. Therefore, the effects of broad-scale direction on these species are general in nature as opposed to species-specific. Further analysis of effects of proposed management on these species or their habitats should be conducted on a finer-scale such as during step-down processes (land use planning amendment and revision, Subbasin Review, EAWS, and/or site-specific NEPA analyses).

General

All three alternatives would benefit vascular and non-vascular plants through protection of special habitat features (such as downed wood). The restoration of habitats that have declined substantially in geographic extent from the historical to current period, and the repatterning of vegetation across the landscape in Alternatives S2 and S3 would improve habitat diversity for and stability of plant communities to a greater extent than Alternative S1. Alternatives S2 and S3 would also reduce the adverse effects of invasive exotic plant species through Integrated Weed Management and restoration of native species to a greater extent than would Alternative S1 (see section on Noxious weeds). Furthermore, Alternatives S2 and S3 would have general, beneficial effects on widely distributed plants of concern and rare plant communities through step-down processes, and through prioritization and preparation of conservation strategies for widely distributed plants.

Unnaturally dense forest stands are often unsuitable habitat for many plant species, such as some lichen species. Alternatives S2 and S3 should improve habitat for such species through the use of thinning and prescribed fire to move stands closer to the historical range of variability.

Biological Crusts

As noted in Chapter 2, biological crusts are most prevalent on arid rangelands, primarily in the dry shrub potential vegetation group (PVG), where above-ground plant production is inherently low. Biological crusts influence many processes, including soil stability, nutrient cycling, infiltration and soil

moisture, and interactions with vascular plants. Activities that disturb the soil surface, including fire, livestock grazing, off-road vehicle use, recreational hiking, and others, can reduce the maximum potential development of biological crusts.

Although more research would help clarify the roles that biological crusts play, perhaps the most agreed upon contribution of biological crusts to rangeland health is its role in stability of rangeland soils. Biological crusts stabilize fine soil particles at the soil surface. This role alone, according to Johnson and Kingery (1999), provides sufficient justification for evaluating the effects of the alternatives on biological crusts.

The potential for biological crusts to develop and increase in geographic extent is and would continue to be meager on sites that have already crossed a threshold or will cross a threshold in the next 100 years. In particular, the potential is and would be meager on sites that are already dominated by fine fuels (such as the exotic annual grasses cheatgrass and medusahead) or will become so in the next 100 years. On these sites the potential is meager regardless of management direction, meaning that even if livestock grazing management would be improved, for example, conditions would not revert back to their pre-threshold state, exotic annual grasses would still dominate, and therefore conditions would not likely become more favorable for biological crust development. Restoration that achieves wholesale conversion of the exotic annual grasses to perennial species, such that the exotic annual grasses are still present but no longer dominate, would be necessary to foster biological crust development. Conversely, on sites that have yet to cross a threshold, changes in management show greater potential to foster development of biological crusts and increase their geographic extent.

On rangeland sites that have not and will not cross a threshold in 100 years, conditions required for development of biological crusts would trend toward historical under all alternatives, with Alternatives S2 and S3 coming the nearest to historical conditions for biological crust development. All alternatives emphasize Healthy Rangelands direction to some degree (Alternative S1 on BLM-administered lands, and Alternatives S2 and S3 on both Forest Service- and BLM-administered lands). Therefore, all alternatives would stimulate changes in livestock grazing management that promote developing and maintaining biological crusts. Alternatives S2 and S3 would provide additional restoration focus on biological crusts over Alternative S1, attributable directly or indirectly to:

1. A project-area wide Integrated Weed Management (IWM) strategy. This would reduce the expansion rate of exotic undesirable plants more than under Alternative S1, which lacks a project-area wide IWM.
2. A focus on managing land uses (such as livestock grazing) and reducing the geographic extent of exotic undesirable plants to provide favorable conditions for biological crust development where development potential is high (for example, in the salt desert shrub cover type, Wyoming big sagebrush portion of the big sagebrush cover type, and the low sage cover type).
3. A focus on instituting changes to livestock grazing management in areas that are "functioning at risk" and therefore at risk of crossing a threshold.
4. A short-term conservation emphasis and a long-term restoration emphasis for terrestrial source habitats within T watersheds that have declined substantially in geographic extent from historical to current periods.
5. High restoration priority subbasins, where additional priority would be given to implement restoration direction. This would result in livestock grazing management changes, exotic undesirable plant control, and reestablishment of native plant vegetative types.

Under all alternatives, conditions required for development of biological crusts would trend *toward* historical conditions in both the project area and the high restoration priority subbasins. Conversely, under all alternatives, the geographic extent of biological crusts would trend *away* from historical extent for the project area as a whole, but would trend *toward* historical extent in the high restoration priority subbasins in Alternatives S2 and S3. Expansion of exotic undesirable plants would continue under all alternatives, with Alternatives S2 and S3 slowing the expansion to a greater degree than Alternative S1. More acres with potential for biological crust presence will cross a threshold and be dominated by exotic undesirable plants in Alternative S1 compared with Alternatives S2 and S3. Comparing Alternatives S2 and S3 within the high restoration priority subbasins, both would slow the expansion of exotic undesirable plants, with Alternative S2 achieving slightly more decline in geographic extent of exotic undesirable plants than Alternative S3.

Table 4-18 summarizes the effects of the alternatives on biological crust development and extent in the dry shrub PVG, where biological crusts are most prevalent. Trends are reported for the entire project area and for the high restoration priority subbasins, for each alternative, on lands administered by the BLM and the Forest Service, as related to historical geographic extent.

Conclusions

Alternatives S2 and S3 would provide for more improvement of ecosystem processes and functions than Alternative S1. This, along with direction to develop conservation strategies and address risks through step-down, would provide more benefits to vascular and non-vascular plants and rare plant communities than would Alternative S1. Alternatives S2 and S3 should provide for stable populations of these species and communities over the next 100 years, while populations may decrease under Alternative S1. The likelihood of persistence for these species should be stable with Alternatives S2 and S3, but would be reduced with Alternative S1.

Cumulative Effects (All Lands)

The effects of activities predicted to occur on lands not administered by the Forest Service or BLM would affect plant species similarly with implementation of any of the alternatives. Generally habitat conditions would be less favorable on all lands than on Forest Service- and BLM-administered lands primarily because of the increased effect of human activities on many private lands. Although specific effects on vascular and non-vascular plants from activities on all lands can not be predicted, it is possible that the cumulative effect on these species over the next 100 years would be a slight decrease in geographic extent from the current extent.

Table 4-18. Biological Crust Development and Extent within the Dry Shrub Potential Vegetation Group (PVG) in the Project Area,[1] at 100 Years.

	Trend toward (T), or Away (A) from Historical			Alternative That Comes Nearest to Returning Biological Crust *Development* or *Extent* to Historical
	Alternative S1	Alternative S2	Alternative S3	
			Biological Crust Development within Dry Shrub PVG	
Project Area	T	T	T	S2=S3
High Restoration Priority Subbasins in Alternative S2	T	T	T	S2=S3
High Restoration Priority Subbasins in Alternative S3	T	T	T	S2=S3
			Biological Crust Extent within Dry Shrub PVG	
Project Area	A	A	A	S2=S3
High Restoration Priority Subbasins in Alternative S2	A	T	T	S2
High Restoration Priority Subbasins in Alternative S3	A	T	T	S2

[1] Project Area = Forest Service- or BLM-administered lands in the project area.

Source: Interpreted from Johnson and Kingery (1999); ICBEMP GIS data; Hemstrom et al. 1999.

Definitions

Environmental Index - A measure of the capability of a watershed or subwatershed to support a species.

Extirpation - Loss of populations from all or part of a species' range within a specified area.

Habitat Capacity - A weight-averaged environmental index in which the weights are the areas of each Hydrologic Unit Code (HUC). The weight average is presented in this EIS as a percentage of historical weight-average.

Habitats that have declined substantially in geographic extent from the historical to the current period- Those cover type–structural stage combinations that have declined by more than 20 percent in more than half of the Ecological Reporting Units (ERUs) where the historical extent is 50 percent of the ERU area or greater and where the overall net change in extent from historical to current is negative (see the cover type-structural stage discussion in Chapter 2).

Likelihood of Persistence- A relative measure of risk developed by the EIS Team, related to changes in habitat conditions, to the continued distribution of species in a Terrestrial Family on Forest Service- and BLM- administered lands. Three relative rating levels were used: good, fair, or poor. A rating is established for a Family based on the predicted effects on modeled species in that Family. Given the selection criteria for the species modeled as described in the Terrestrial Effects Analysis of SDEIS Alternatives (Raphael et al. 1999), it is assumed that risk to species not modeled would be similar to or less than the modeled species, unless specific factors such as low population size are involved. The ratings are determined based on predicted conditions resulting from the alternatives analyzed. An assumption is that improving habitat conditions should result in reduced risk to species persistence. The habitat variables reviewed to arrive at a rating were: the amount and trend of source habitat, the level and trend of the habitat capacity as a percent of historical, the trend in extent of habitat, and the environmental outcome. Generally, the trends described for the various ratings in the following paragraphs were consistent. However, there were a few exceptions where one of the variables did not conform. These exceptions are discussed where there is a difference from the overall rating for each grouping of Families (discussion related to each exception is included in the planning record).

A rating of "good" would be associated with predicted habitat conditions that would generally be improving over the next 100 years and indicates that there should be minimal risk to persistence of the species based on the predictions. Generally, the predicted amount of source habitat, predicted habitat capacity as a percent of historical and predicted extent of habitat are increasing, and the environmental outcome will be an "A" or "B".

A rating of "fair" would be associated with predicted habitat conditions that would be stable over the next 100 years and indicates that there would be some risk to persistence of the species based on the predictions. Generally, the predicted amount of source habitat, predicted habitat capacity as a percent of historical and predicted extent of habitat are stable (within +or- 10 percent of current), and the environmental outcome will be a "C".

A rating of "poor" would be associated with habitat conditions that would be declining or stable at a relatively low level over the next 100 years, or associated with other limiting factors (such as small population size); a poor rating indicates that there would be substantial risk to persistence of the species based on the predictions. Generally, the predicted amount of source habitat, predicted habitat capacity as a percent of historical and predicted extent of habitat are decreasing, and the environmental outcome will be a "D" or "E".

Habitat conditions for a Family or species with a poor rating indicate a need for priority for restoration of habitat (or factors that are reducing the value of habitat) and careful monitoring to assure habitat conditions do not become worse than predicted. For example, various management options were tested to determine the potential for improving the outcomes. The most promising was increasing the level of restoration actions in subbasins with potential to improve habitat conditions. The possible effects of doing so were tested for sage grouse. By focusing on 20 subbasins within the range of sage grouse and assuming approximately 20 million dollars, it was possible to raise the basin-wide outcome for sage grouse, although the outcome class did not change.

Outcomes- A characterization of the likely distribution and relative abundance of each species across its range in the project area. Two types of outcomes are reported:

Environmental outcome- A characterization of outcome based on habitat capacity, range extent, and connectivity. This outcome is reported for all lands in the project area and for Forest Service- and BLM-administered lands. It can be interpreted for Forest Service- and BLM-administered lands in much the same way as the federal habitat outcomes were reported in the Draft EISs.

Population outcome- A characterization of outcome based on habitat capacity, range extent, and connectivity and which accounts for other influences that could have pervasive effects on a species population (such as other organisms and small population size). Population outcome levels are reported for all lands, and are similar to the cumulative effects outcomes in the Draft EISs.

Source Habitats- Those characteristics of vegetation that support long-term species persistence or characteristics of vegetation that contribute to stable or positive population growth for a species in a specified area and time.

Successional Momentum- The increasing departure (change) of landscape vegetation, structure, composition, patch, pattern, and disturbance regimes away from the historical range at an increasing rate.

Terrestrial Family- An aggregate of groups of broad-scale terrestrial vertebrate species of focus for the ICBEMP, organized into "families" based on habitat requirements (Wisdom et al. in press). Twelve Terrestrial Families are discussed in this EIS.

Terrestrial Invertebrates

Methodology: How Effects on Terrestrial Invertebrates were Estimated

As discussed in Chapter 2 of this EIS, habitat requirements for invertebrates are generally at a scale so fine that it is difficult to precisely establish their current condition and status or to determine the effects of the broad-scale direction in the alternatives. However, it is possible for the EIS Team to discuss general issues and compare the general effects of the alternatives on these issues. Further analysis of effects of proposed management on these species or their habitats should be conducted on a local basis during site-specific NEPA analysis.

Effects of the Alternatives on Terrestrial Invertebrates

All three alternatives would have a positive effect on invertebrates by protecting special habitat features such as talus and caves and maintaining soil structure, although the consistency in approach would be enhanced in Alternatives S2 and S3. In addition, Alternatives S2 and S3 would have a positive effect on invertebrates by improving diversity and sustainability of habitats through restoration of those habitats that have declined substantially in geographic extent from historical to current periods. Furthermore, Alternatives S2 and S3 would reduce the negative effects of pesticides and restore frequent, low intensity fire where it would be appropriate to repattern vegetation to a greater extent than Alternative S1.

Implementation of Alternatives S2 and S3 would increase understory vegetation, restore temperature regimes, and improve decomposition rates through thinning and increased use of prescribed fires. These actions would reduce densely stocked stands, which would increase the amount of sunlight reaching the forest floor compared with implementation of Alternative S1.

All three alternatives would improve soil stability, soil productivity, and plant cover by reducing soil compaction and displacement during management activities. In addition, Alternatives S2 and S3 would further benefit invertebrates by improving habitat effectiveness through restoration of vegetation patches, patterns, structure, and species composition by repatterning vegetation to be more consistent with the landform, climate, biological and physical characteristics of the area.

Conclusions

Specific effects on invertebrates can not be predicted from broad-scale data. However, all three alternatives would provide general positive benefits for invertebrates. Alternatives S2 and S3 would provide for more improvement of ecosystem processes and functions than does Alternative S1. Therefore, Alternatives S2 and S3 should provide more general benefits to invertebrates than does Alternative S1.

Cumulative Effects (All Lands)

The effects of activities predicted to occur on lands not administered by the Forest Service or BLM would affect invertebrate species similarly with implementation of any of the alternatives. Generally habitat conditions would be less favorable on all lands than on Forest Service- and BLM-administered lands primarily because of the increased effect of human activities on many private lands. Although specific effects on invertebrates from activities on all lands can not be predicted, it is possible that the cumulative effect on these species over the next 100 years would be a slight decrease in geographic extent from current.

Broad-scale Terrestrial Vertebrates

Methodology: How Effects on Terrestrial Vertebrates were Estimated

Landscape Model

Landscape projection models used by the SAG predicted trends in vegetation composition and structure resulting from management activities and succession. Projected future conditions reflect estimates of vegetation cover 100 years into the future under prescriptions and land allocations of each alternative. The predicted amounts of vegetation were input into the terrestrial models.

Terrestrial Models

Wisdom et al. (in press) identified 91 broad-scale species of focus (see Chapter 2, Terrestrial Species section). For more detailed analyses, a subset of 28 species (31 species-seasonal combinations) was selected from the 91 species as a representative cross-section of the variation in environmental requirements. This selection was made by examining environmental requirements of all 91 species. The concept of focal species (Lambeck 1997), the findings of Wisdom et al. (in press), and the structure of the models were applied to make this selection. The intent was to select a set of species to represent the full array of species responses to conditions projected under the management alternatives.

Note: Specific model predictions are not presented here for the brown-headed cowbird, because issues relating to this species on Forest Service- and BLM-administered lands are localized in nature and are best addressed at a finer scale through the step-down process. There was no difference between alternatives in effects on this species at the broad scale. The model predictions are contained in the planning record.

Two complementary types of Bayesian Belief Network models (see sidebar) were developed by the SAG: an Environmental Index model and a Population Outcome model. A basic assumption of model development and interpretation is that conditions existing historically provided adequate habitat condition for species. The models are working hypotheses that have not yet been validated through monitoring and research (Raphael et al. 1999).

Environmental Index Model

This Environmental Index Model was used by SAG to characterize the quantity and quality of habitat and other environmental factors affecting populations of each species. Input data for this model were primarily derived from outputs of the landscape model. The index incorporates source habitat and additional aspects of habitat quality and other influences that affect species. For large species with extensive home ranges (grizzly bear, gray wolf, lynx, and wolverine),

Bayesian Belief Network (BBN) Models

A Bayesian Belief Network (BBN) is a model in graphical form representing a multivariate probability distribution of random variables (Haas 1991). The graphical form of a BBN resembles a flowchart in which variables (referred to as nodes) are linked with arrows, representing causal influences among the variables. A BBN is directed so influences among variables flow in one direction only; because there are no arrows leading back to input variables, they are acyclic. BBNs provide a quantitative framework that allows information from both empirical data and expert opinion to be combined in an evaluation process.

Outcomes for each node are described by predicted levels or states, which are expressed as probabilties. For example, the state levels "Yes" (probability of occurrence = 0.65) and "No" (probability of non-occurrence = 0.35) could define a node representing a large flood event.

For further information on the BBN models, see Quigley 1999.

watersheds were used as the basic unit of analysis. For other species, subwatersheds were used as the basic unit of analysis.

The results of the environmental index model were summarized in two ways to reflect land ownership patterns. First, the results were computed across all ownerships throughout the project area. Second, each watershed/subwatershed with a land area of 50 percent or more administered by either the Forest Service or Bureau of Land Management (50 percent HUCs) was identified and results computed and summarized for them. Because such a large percentage of subwatersheds contain a mix of Forest Service- and BLM-administered lands with other ownerships, and because the base level model projections were estimated by subwatershed or watershed, it was not possible to partition out all Forest Service- and BLM-administered lands separately from other ownerships for model inputs. The area within these 50 percent watersheds/subwatersheds represents 53 percent of the total land base, and 88 percent of the total Forest Service- and BLM-administered lands in the project area. Approximately 11 million acres of "other" lands are included in the terrestrial model predictions of effects of alternative implementation on Forest Service- and BLM- administered lands.

The results of the environmental index model are reported as "habitat capacity," which is a weight-averaged environmental index in which the weights are the areas of each Hydrologic Unit Code (HUC). The weight average is presented in this EIS as a percentage of the historical weight-average.

Population Outcome Model

This model was used by SAG to summarize the spatial distribution of watershed/subwatershed-level results generated from the environmental index model to evaluate outcomes for species across the entire basin for any point in time for any alternative. This model has three primary inputs: (1) an index of overall habitat capacity, (2) a measure of the extent of a species' range, and (3) a measure of habitat connectivity. The overall status of a species was characterized by assigning likelihoods to each of five possible outcomes, labeled A to E.

Again, SAG performed two sets of model calculations, one based on all lands within the project area, and one restricted to watersheds or subwatersheds containing at least 50 percent Forest Service- and BLM- administered lands.

The population outcome model has two findings. The first is a characterization of outcome, based on the three nodes described above (habitat capacity, range extent, and connectivity). This set of outcomes is referred to as *environmental outcomes* (not to be confused with *environmental index*). These outcomes can be interpreted in much the same way as the federal habitat outcomes reported in the Draft EISs. The second set is referred to as *population outcomes* and accounts for other influences that could affect a species population throughout its range. These influences included presence of other influential organisms (for example, presence of predators of woodland caribou), and small population size (a factor to adjust for demographic effects of small populations). The population outcome levels are similar to the cumulative effects outcomes in the Draft EISs.

The outcome classes, A to E, are broad classes based on expected values which were predicted on a numeric scale of one to five. As discussed in the following section it is not possible to estimate the overall uncertainty related to the expected values. However, a standard deviation of the probability distribution was calculated for the Bayesian model outputs. For a normal (gaussian) distribution, 68.2 percent of the probability is within one standard deviation of the mean. The standard deviation is only one measure of the uncertainty associated with model outputs, and it is likely that other sources of uncertainty, such as inaccuracy of model inputs, would increase the size of the standard deviation about the mean expected values of the environmental and population outcomes. Consequently, any conclusions made about a difference in outcomes based on a variation of one standard deviation or less must be interpreted with caution and with the above considerations in mind.

Rationale for Qualitative Interpretation of Modeling of Management Alternatives

The value and limitations of models has been discussed, in general terms, in the introduction to this chapter. These caveats are applicable to the models used for the terrestrial species analysis.

- Some of the specific direction from Alternatives S2 and S3 may not be fully reflected in the SAG's landscape models or management prescriptions. In Alternatives S2 and S3 in areas where high concentrations of restoration activities would occur with a focused restoration design (for example, where EAWS takes place or in T watersheds), landscape projections would likely be

better than were predicted for the following: levels of snags and downed wood, reduction in HRV departure, restoration of habitats that have declined substantially in geographic extent from the historical to current period, reduction in livestock grazing effects, and reduction in noxious weeds and exotic plants (SAG, personal communication, November 1999).

- Cover type and structural stage estimates of vegetation were derived from the landscape model. There is no statistical estimate of the error associated with these predictions. However, high error rates are associated with estimates of cover type and structural stage at the scale of individual subwatersheds (see Hann, Jones, Karl, et al. 1997 and Wisdom et al. [in press] for details), but these errors decline with increasing size of area analyzed, with lowest error rates associated with basin-wide estimates.
- Projected effects of the alternatives on specific environmental attributes (such as snag or log density trend or grazing effects departure) are also subject to estimation errors. Because of uncertainties involved in future projections, these errors are difficult to estimate. In addition, such errors can be propagated with the inclusion of a large number of environmental parameters in a given model. The potential limitations that estimation errors may place on inferences for management have not been quantified.
- Most effects of forest and range management were estimated by using landscape proxies to index the environmental attributes of interest. For example, the degree of HRV departure was used as a proxy for snag species when the tree species is important to a wildlife species. These landscape proxies presumably are correlated with the attribute, but the strength of this correlation is untested. More-

Species Viability and Persistence

Regulations implementing the National Forest Management Act (NFMA) require that:

> *Fish and wildlife habitat shall be managed to maintain viable populations of existing native and desired non-native vertebrate species in the planning area. For planning purposes, a viable population shall be regarded as one which has the estimated numbers and distribution of reproductive individuals to insure its continued existence is well distributed in the planning area. In order to insure that viable populations will be maintained, habitat must be provided to support, at least, a minimum number of reproductive individuals and that habitat must be well distributed so that those individuals can interact with others in the planning area.*

Key points of this requirement are that: (1) the obligation is to provide habitat, but the adequacy of that habitat must be judged on the basis of its capability to support populations; (2) the requirement is to provide for habitat that can support a population that is well-distributed across the planning area, not just a population that can persist within the planning area; (3) the term well-distributed is defined in terms of the ability of individuals of the species to interact with each other. Biological and legal interpretation of the concept of well-distributed has further clarified that it must be judged relative to the life history and historical distribution of the species. Many species were not historically distributed in a continuous fashion across the landscape, and it should not be expected that they would be continuously distributed across the future landscape. Legal interpretation has also clarified that it is not a requirement to absolutely "insure" species viability, but that the level of certainty should reflect both biological reality and needs for multiple uses (see 1994 Dwyer decision, Northwest Forest Plan). Thus, viability and risk must be expressed as variables, and the trade-offs between them made explicit.

The regulation also makes it clear that viability is a requirement of the federal landscape (that is, the planning area). This requirement creates stiff analytical challenges, as species populations operate across entire landscapes with no reference to land ownership. The terrestrial species effects analysis presented in this Supplemental Draft EIS provides the information that the decision makers will use to judge whether federal habitat management meets NMFA requirements. These include analyses of environmental outcomes (a large-scale index of the capability of the environment to support population abundance and distribution); population outcomes (supplementing environmental outcomes by reflecting other influences on species populations such as the effect of small population size); and the availability of habitat for species grouped by similar habitat associations. The necessary analysis that contributes to determining likelihood of viability is presented here; however, the final determination of viability will be made in the Record of Decision.

over, it is possible that many local changes in landscape conditions that may occur under each alternative would not be reflected to their full extent in the landscape proxies.

- The models are meant to portray relative quality of environmental conditions affecting populations over time and among alternatives, not the actual density or population size of a species at any particular location. In this context, it is important to note that the environmental index model estimated relative densities, not absolute densities. The population outcome scale is a relative measure of the amount and distribution of suitable environments. Population outcomes are not a direct measure of population viability.
- The use of subwatersheds or watersheds with 50 percent or more Forest Service- or BLM-administered lands to represent effects on actual Forest Service- or BLM-administered lands increases the level of uncertainty related to effects of the alternatives on Forest Service- and BLM-administered lands. Any Forest Service- or BLM-administered lands in watersheds with less than 50 percent Forest Service- and BLM-administered lands was excluded from the analysis; conversely, any non-Forest Service- or BLM-administered lands in watersheds with 50 percent or more Forest Service- and BLM-administered land was included in the analysis. It was not possible to quantify the degree of uncertainty related to this effect.

Effects of the Alternatives on Terrestrial Vertebrates

This section presents the effects of implementing the alternatives on the broad-scale, terrestrial species of concern (see the Terrestrial Species section in Chapter 2). The evaluation of the effects are directed toward issues identified for the 12 Terrestrial Family groupings in Wisdom et al. (in press). The predictions of the various models developed by the SAG were used to support the discussions and provide an indication of the relative degree of difference among the alternatives.

General Effects on Terrestrial Families Grouped by Similar Habitat Requirements

This section describes the effects on terrestrial species, grouped by Terrestrial Families, which are further grouped by similar habitat conditions. The effects described in the following are related to implementation of the alternatives on Forest Service- and BLM-administered lands. Effects related to all lands in the basin are disclosed in the cumulative effects section.

The analysis indicates that the species modeled should continue to exist in the project area for the next 100 years, with the greatest level of uncertainty and risk associated with those species whose population outcome is "E". Aggressive actions will be necessary to avoid extirpations.

Forested Habitat

Alternative S2 and to a slightly lesser extent Alternative S3 would generally improve overall habitat conditions for species in Terrestrial Families 1, 2, 3, and 4 (see Chapter 2 and Table 4-22, later in this section, for species), which primarily use forested habitat, through restoration and maintenance of habitats that have declined substantially in geographic extent from historical to current periods and the repatterning of vegetation to where it would be sustainable to a greater extent than Alternative S1 (see Terrestrial [Upland] Vegetation effects section, earlier in this chapter, for additional discussion).

Rangeland Habitat

Alternatives S2 and S3 would slow succession momentum and declines in habitat conditions for species in Terrestrial Families 11 and 12, which primarily use rangeland habitat, through: restoration and maintenance of habitats that have declined substantially in geographic extent from historical to current periods; repatterning vegetation to where it would be sustainable; expansion of the area covered by the Healthy Rangeland Strategy; and Integrated Weed Management, to a greater degree than Alternative S1 (see Terrestrial [Upland] Vegetation effects section, earlier in this chapter, for additional discussion).

Forest and Rangeland Habitats

For species in Terrestrial Families 5, 6, 7, 8, 9, and 10 that use a mix of forested and rangeland habitats, Alternatives S2 and S3 would generally improve overall habitat conditions, through restoration and maintenance of habitats that have declined substantially in geographic extent from the historical to the current period and through repatterning of vegetation to where it would be sustainable to a greater extent than Alternative S1. These alternatives would expand the area covered by the Healthy Rangeland Strategy from BLM-administered lands to all Forest Service- and BLM-administered lands in the project area. This direction in combination with an integrated weed

Outcomes

Environmental Outcomes

The environmental outcomes should be thought of as a large-scale index of the capability of the environment to support population abundance and distribution, but not as an actual prediction of population occurrence, size, density, or other demographic characteristics.

Outcome A. Suitable environments are broadly distributed and of high abundance across the historical range of the species. The combination of distribution and abundance of environmental conditions provides opportunity for continuous or nearly continuous intraspecific interactions for the species.

Outcome B. Suitable environments are either broadly distributed or of high abundance across the historical range of the species, but there are gaps where suitable environments are absent or only present in low abundance. However, the disjunct areas of suitable environments are typically large enough and close enough to permit dispersal among subpopulations and to allow the species to potentially interact as a metapopulation (groups of populations) across its historical range.

Outcome C. Suitable environments are distributed frequently as patches and/or exist at low abundance. Gaps where suitable environments are either absent or present in low abundance are large enough that some subpopulations are isolated, limiting opportunity for species interactions. There is opportunity for subpopulations in most of the species range to interact as a metapopulation, but some subpopulations are so disjunct or of such low density that they are essentially isolated from other populations. For species for which this is not the historical condition, reduction in overall species range from historical may have resulted from this isolation.

Outcome D. Suitable environments are frequently isolated and/or exist at very low abundance. While some of the subpopulations associated with these environments may be self-sustaining, there is limited opportunity for population interactions among many of the suitable environmental patches. For species for which this is not the historical condition, reduction in overall species range from historical may have resulted from this isolation.

Outcome E. Suitable environments are highly isolated and exist at very low abundance, with little or no possibility of population interactions among suitable environmental patches, resulting in strong potential for extirpations within many of the patches, and little likelihood of recolonization of such patches. There has likely been a reduction in overall species range from historical, except for some rare, local endemics that may have persisted in this condition since the historical time period.

Population Outcomes

The following definitions of population outcome classes reflect the availability of both federal and non-federal habitat and environmental conditions within the project area, and all other influences on the species population that are not accounted for in the modeling of environmental outcomes.

Outcome A. The combination of environmental and population conditions provides opportunity for the species to be broadly distributed and of high abundance across its historical range. There is potential for continuous or nearly continuous intraspecific interactions at high population size.

Outcome B. The combination of environmental and population conditions provide opportunity for the species to be broadly distributed and/or of high abundance across its historical range, but there are gaps where populations are potentially absent or only present in low density as a result of environmental or population conditions. However, the disjunct areas of higher potential population density are typically large enough and close enough to other subpopulations to permit dispersal among subpopulations and to allow the species to potentially interact as a metapopulation across its historical range.

Outcome C. The combination of environmental and population conditions restrict the potential distribution of the species, which is characterized by patchiness and/or areas of low abundance. Gaps where the likelihood of population occurrence is low or zero are large enough that some subpopulations are isolated, limiting opportunity for species interactions. There is opportunity for subpopulations in most of the species range to interact as a metapopulation, but some subpopulations are so disjunct or of such low density that they are essentially isolated from other populations. For species for which this is not the historical condition, reduction in overall species range from the historical range may have resulted from this isolation.

Outcome D. The combination of environmental and population conditions restrict the potential distribution of the species, which is characterized by areas with high potential for population isolation and/or very low potential abundance. While some of these subpopulations may be self-sustaining, gaps where the likelihood of population occurrence is low or zero are large enough that there is limited opportunity for interactions among them. For species for which this is not the historical condition, reduction in overall species range from historical has likely resulted from this isolation.

Outcome E. The combination of environmental and population conditions restricts the potential distribution of the species, which is characterized by high levels of isolation and very low potential abundance. Gaps where the likelihood of population occurrence is low or zero are large enough there is little or no possibility of interactions, strong potential for extirpations, and little likelihood of recolonization. There has likely been a reduction in overall species range from historical, except for some rare, local endemics that may have persisted in this condition since the historical time period.

management strategy also would contribute to improvement of habitat conditions for these families, compared to Alternative S1.

Habitats that have Declined Substantially

EIS Team analysis indicates that habitats that have declined substantially in geographic extent from the historical to the current period would generally be maintained or increased in all terrestrial communities, except upland shrubland, in all alternatives (see Table 4-19). Generally Alternatives S2 and S3 are predicted to increase the geographic extent of these habitats more than Alternative S1. Further, species composition and habitat connectivity would be improved with Alternatives S2 and S3 because of their emphasis on repatterning.

The emphasis on maintaining source habitats in T watersheds and on restoration in the high restoration priority subbasins would have a positive effect on habitats that have declined substantially in geographic extent from the historical to the current period. Alternatives S2 and S3 generally would restore more acres in these areas than Alternative S1.

Snags

Generally, the number of snags would increase on Forest Service- and BLM-administered lands at the end of 100 years (see Table 4-20). All alternatives generally would maintain or restore large snags and downed wood to above historical levels, although Alternatives S1 and S3 would provide less flexibility to modify snag and downed wood amounts to reflect local conditions. The primary exception to maintaining snags levels would be that snags of shade-intolerant species in the dry forest potential vegetation group and to a lesser extent in the moist forest potential vegetation group are predicted to decrease. A predicted lack of snags from old, shade-intolerant tr e species restricted the environmental index for ma y species modeled. The landscape models did n t distinguish which tree species would generate sna s in the future. Management direction in Alternativ s S2 and S3 that favors production of large snags fr m shade-intolerant tree species might improve habit t for some species in Terrestrial Families 1, 2, and 8 more than the models predicted (see Table 4-25, later in this section). Alternative S1 would maintain large snags within the areas covered by the Eastside

Table 4-19. Extents of Habitats that Have Declined Substantially within Six Categories of Terrestrial Communities, Current and by Alternative at 100 years.

Terrestrial Community Category	Current	Alternative S1	Alternative S2	Alternative S3
		Percent of Historical Levels		
Subalpine Forest[1]	21	122	123	123
Montane Forest[2]	36	62	64	64
Lower Montane Forest[3]	29	77	79	78
Upland Woodland[4]	55	229	231	230
Upland Shrubland[5]	63	41	42	42
Upland Herbland[6]	33	82	80	80

[1] Mountain hemlock: young multi-story; old multi-story. Whitebark pine/alpine larch: stand initiation; young multi-story; old multi-story; stem exclusion, open. Whitebark pine: stand initiation; young multi-story; old multi-story; stem exclusion, closed. Engelmann spruce/ subalpine fir: young multi-story; old multi-story.

[2] Interior Douglas-fir: stem exclusion, closed. Western larch: stand initiation; young multi-story; old multi-story; old single story. Western white pine: stand initiation; stem exclusion, closed; understory reinitiation; old multi-story. Lodgepole pine: stand initiation; young multi-story; old single story. Western redcedar/ Western hemlock: young multi-story. Cottonwood/willow: understory reinitiation; old multi-story. Sierra Nevada mixed conifer: stand initiation; young multi-story; stem exclusion, closed; understory reinitiation; old multi-story.

[3] Interior ponderosa pine: stand initiation; stem exclusion, closed; old multi-story; old single story. Pacific ponderosa pine: stem exclusion, closed; old multi-story.

[4] Mixed conifer woodlands: woodlands.

[5] Alpine tundra: closed, low, medium shrub. Shrub wetlands: open, low, medium shrub; closed tall shrub. Antelope bitterbrush/ bluebunch wheatgrass: closed, low, medium shrub. Mountain mahogany: open, low, medium shrub. Mountain big sagebrush: open, low, medium shrub. Chokecherry/seviceberry/rose: closed, low, medium shrub. Big sagebrush: open low, medium shrub; closed, low, medium shrub.

[6] Wheatgrass/bunchgrass: closed herbland; open herbland. Fescue bunchgrass: closed herbland; open herbland. Big sagebrush: closed herbland.

Source: ICBEMP GIS Data (converted to 1 km^2 raster data).

Table 4-20. Current and Predicted Number[1] of Large Snags and Pieces of Downed Wood Per Acre in the Project Area,[2] by Potential Vegetation Group (PVG) and Alternative, at 100 years.

Potential Vegetation Group	Current	Alternative S1	Alternative S2	Alternative S3
		Number of Large Snags Per Acre		
Cold Forest	4.23	4.57	4.65	4.60
Dry Forest	1.56	1.22	1.79	1.65
Moist Forest	3.89	4.59	4.47	4.59
Riparian Woodland	1.82	4.13	4.67	4.49
Woodland	0.40	0.40	0.26	0.35
		Downed Wood Pieces Per Acre		
Cold Forest	9.14	9.57	9.58	9.57
Dry Forest	2.41	2.49	2.86	2.80
Moist Forest	8.00	8.11	5.56	6.58
Riparian Woodland	1.45	1.84	2.52	2.43
Woodland	0.40	0.40	0.26	0.35

[1] See Table 2-23b in Chapter 2 for historical numbers.
[2] Project Area = Forest Service- or BLM-administered lands in the project area.

Source: Hemstrom et al. 1999.

Screens, but outside these areas fewer large snags could be maintained. Therefore, Alternatives S2 and S3 would have substantially better effects than Alternative S1 regarding snag levels.

Unroaded Areas

There would be fewer areas with high and very high road densities under all alternatives (see Table 4-21). The reductions would be from very high to high road density class and from high to moderate road density class and would be greater with Alternatives S2 and S3 than with Alternative S1. There also would be substantially more areas with decreasing trends in road density with Alternatives S2 and S3 compared to current and Alternative S1 (see Table 4-22). There would continue to be adverse effects from human activities associated with roads; however, these decreases in road density should reduce the effects on species.

Effects on Terrestrial Families Grouped by Similar Trends in Effects

This section describes the effects on Terrestrial Families that are similar in trend. The effects on species in each of the 12 Terrestrial Families were reviewed and it was determined that the 12 Terrestrial Families could be separated into three groups by similar trends in effects: Terrestrial Families 1, 2, 3, 4, 6, 8,and 9; Terrestrial Families 5, 7, and 10; and Terrestrial Families 11 and 12. In the following sections, both the geographic extent of source habitats and habitat capacity are discussed.

Improving or Stable Trends

Habitat conditions for Terrestrial Families 1, 2, 3, 4, 6, 8, and 9 are generally predicted to be improving or stable. Species in these families depend on forested habitat or a mix of forest, woodland and rangeland habitat. Landscape modeling results indicate that total source habitats would generally increase in geographic extent over the next 100 years on BLM- and Forest Service-administered lands and in some cases may equal or exceed historical acres for species in these Families (see Table 4-23). Total source habitat would, in most cases, equal or exceed 65 percent of historical levels. Management direction in Alternatives S2 and S3 is similar in intent to that represented by the Eastside Screens for Oregon and Washington in Alternative S1, relative to maintaining old forests, and it extends this intent throughout the project area. The outcome-based direction in Alternatives S2 and S3 does not contain specific direction relative to northern goshawk, as is included in the Eastside Screens. Alternatives S2 and S3 direction goes beyond the Eastside Screens by directing restoration and repatterning of old forest types to areas where they would be sustainable, which

Table 4-21. Area of Road Density Classes and Percent of Road Density Classes in the Project Area,[1] Current and by Alternative, at 100 years.

	Current		Alternative S1		Alternative S2		Alternative S3	
Class[2]	Million Acres	Percent	Million Acres	Percent	Million Acres	Percent	Million Acres	Percent
None	20.0	31	20.0	31	20.0	31	20.0	31
Very Low	4.2	7	4.2	7	4.2	7	4.2	7
Low	6.6	10	6.5	10	6.6	10	6.6	10
Moderate	15.8	25	18.5	29	20.3	32	20.0	31
High	14.4	23	12.0	19	10.7	17	11.0	17
Extremely High	2.6	4	2.3	4	1.7	3	1.8	3

[1] Project Area = Forest Service- or BLM-administered lands in the project area.
[2] None = 0.0 to <0.02 miles of road, Very Low = 0.02 to <0.1 miles of road per square mile, Low = 0.1 to <0.7 miles of road per square mile, Moderate = 0.7 to <1.7 miles of road per square mile, High = 1.7 to <4.7 miles of road per square mile, Extremely High = >4.7 miles of road per square mile.

Source: Hemstrom et al. 1999.

generally would lead (with a few exceptions) to modest increases in total source habitats compared to Alternative S1.

Also, Alternative S1 is projected to provide slightly more source habitat (one to three percent) for the western bluebird, Lazuli bunting and blue grouse than Alternatives S2 or S3. It appears that this increase is due to a higher amount of early seral forest in Alternative S1. Alternative S1 takes a passive approach at managing mid seral forest and protecting late seral forest, while Alternatives S2 and S3 place emphasis on reducing risk of crown fires in mid seral forests, protecting late seral forests, restorating early seral conditions that were created through past logging, and restoring mid seral forests that were created through fire exclusion. This difference in focus results in a slightly higher level of early seral forest under Alternative S1. However, the early seral forest of Alternatives S2 and S3 would be more similar in composition and structure to habitats that existed historically and would be more likely to be sustained than would the early seral forest conditions in Alternative S1. Thus, the habitat in Alternatives S2 and S3 would likely be of higher quality than that of Alternative S1. Since there is no difference in the environmental outcomes among the alternatives for these species except the western bluebird (Table 4-26), the differences in amount of source habitat among alternatives represent local (among watersheds) effects compared to basin-wide effects on Forest Service- and BLM-administered lands. In the case of the western bluebird, the environmental outcome with Alternatives S2 and S3 would be better than with Alternative S1 because of other direction which offsets the lower amount of source habitat.

Alternative S1 is projected to provide slightly more source habitat (one to five percent) for ash-throated flycatcher and western bluebird than Alternatives S2

Table 4-22. Trends in Road Density in the Project Area,[1] Acres and Percent, by Alternative, at 100 years.

	Alternative S1		Alternative S2		Alternative S3	
Class	Million Acres	Percent	Million Acres	Percent	Million Acres	Percent
Increasing	0.1	0	0.1	0	0.1	0
Stable	57.8	91	43.9	69	45.0	71
Decreasing	5.7	9	19.5	31	18.5	29

[1] Project Area = Forest Service- or BLM-administered lands in the project area.

Source: Hemstrom et al. 1999

Table 4-23. Current and Predicted Amounts of Source Habitats, by Terrestrial Species and Alternative, at 100 years.

Species	Current	Alternative S1	Alternative S2	Alternative S3
		Percent of Historical Levels		
Family 1				
pygmy nuthatch	38	62	69	69
Lewis' woodpecker (migrant)	23	55	69	67
Family 2				
American marten	67	100	105	105
flammulated owl	47	84	90	89
northern goshawk (summer)	68	93	100	99
hoary bat	69	88	92	92
black-backed woodpecker	71	93	102	101
woodland caribou	73	291	277	285
Family 3				
blue grouse (summer)	85	128	125	125
lynx	121	111	112	113
wolverine	110	115	116	116
Family 4				
lazuli bunting	84	78	75	76
Family 5				
gray wolf	100	102	102	102
grizzly bear	100	106	105	105
Rocky Mountain bighorn sheep (summer)	76	69	68	68
Rocky Mountain bighorn sheep (winter)	64	65	63	63
Family 6				
rufous hummingbird	86	115	117	117
northern goshawk (winter)	72	97	103	102
Family 7				
long-eared myotis	95	91	91	91
Family 8				
western bluebird	68	79	78	78
Family 9				
ash-throated flycatcher	181	93	88	91
Family 10				
pronghorn	90	91	87	87
short-eared owl	93	91	90	90
striped whipsnake	95	95	90	90
Washington ground squirrel	20	22	21	21
Family 11				
Brewer's sparrow	93	68	70	69
sage grouse (summer)	92	70	72	72
sage grouse (winter)	91	70	72	72
Family 12				
Columbian sharp-tailed grouse (summer)	82	78	73	73
grasshopper sparrow	72	36	39	39

Source: Raphael et al. 1999.

or S3. One primary difference in habitats for these species in all alternatives is change in woodland cover types. Management direction intended to provide benefits for multiple species in Alternatives S2 and S3 is aimed at halting the encroachment of woodlands, especially juniper woodlands, on sites where woodlands did not occur historically. The increased vulnerability of these cover types to wildfire, induced through fine fuel buildup as livestock grazing decreases, is evident in all alternatives by the increases projected in wildfire occurrence within these types. These woodland cover types remain, or even increase, with Alternative S1, because it is passive on the issue of woodland encroachment. However, the amount of this source habitat type is projected to remain abundant with all alternatives. The woodland source habitat that is conserved or restored with Alternatives S2 or S3 is likely to be of higher quality than with

Alternative S1. Since there is no difference in the environmental outcomes among the alternatives for these species except the western bluebird (Table 4-26), the differences in amount of source habitat among alternatives represent local (among watersheds) effects compared to basin-wide effects on Forest Service and BLM-administered lands. In the case of the western bluebird, the environmental outcome with Alternatives S2 and S3 would be better than with Alternative S1 because of other direction which offsets the lower amount of source habitat.

The number of areas with a high or low environmental index for species in these seven Families generally would increase on Forest Service- and BLM-administered lands to a similar degree with all alternatives, because many areas that currently are without habitat would gain habitat. For example, with pygmy nuthatch the percentage of total subwatersheds with either a high or low environmental index would increase from 53 percent currently to 93 percent in 100 years with Alternative S2. This indicates either an expansion of habitat into subwatersheds currently without habitat, or an improvement in habitat quality in those subwater-sheds. There would generally be increases in the percentage of subwatersheds with predicted high or low environmental index (see Table 4-24) indicating an expansion of habitat. The repatterning of vegetation in Alternatives S2 and S3 should improve connectivity, and the increases in geographic extent of source habitat would be more sustainable than under Alternative S1.

The habitat capacity on Forest Service- and BLM-administered lands compared to current generally would show substantial increases for the species in these seven Families (see Table 4-25). There would be a slight decrease for lynx. A predicted lack of snags from old, shade-intolerant tree species restricted the habitat capacity for many species modeled. Management direction in Alternatives S2 and S3 that favors production of large snags from shade-intolerant tree species might improve habitat conditions for species in Terrestrial Families 1, 2, and 8 more than the models predict. The EIS Team concluded that the benefits of Alternatives S2 and S3, which contain direction for wide-ranging carnivores to minimize and mitigate adverse effects of management and develop broad-scale linkages which are not reflected in modeled results, should be somewhat higher than in Alternative S1 for lynx and wolverine. Low population size and human disturbance would limit the potential for wolverine to respond to improvements in habitat. Low population size would also limit lynx, and competition with other predators may further limit this species. Low population size and predation by cougars would limit woodland caribou recovery to lower levels than the amount of source habitat indicates.

In summary, habitat conditions on BLM- and Forest Service-administered lands for the species in Terrestrial Families 1, 2, 3, 4, 6, 8, and 9 generally would improve over the next 100 years under all three alternatives. Model predictions of the environmental outcomes on BLM- and Forest Service-administered lands for species in these Families would not vary among alternatives by greater than one standard deviation, except for the black-backed woodpecker with Alternatives S2 and S3 better than Alternative S1, at the basin-wide scale (see Table 4-26). Alternatives S2 and S3 contain, along with other direction, specific direction to: restore habitats that have declined substantially in geographic extent from the historical to the current period, maintain and recruit snags, repattern vegetation consistent with the landscape, and reduce road effects. Therefore, at the watershed level, implementation of the direction in Alternative S2, followed closely by Alternative S3, should create improved habitat conditions for species in these Families compared to Alternative S1. The predicted trends in environmental outcomes for species in these Families would be increasing for 14 of 16 species modeled with Alternatives S2 and S3, and 13 of 16 species with Alternative S1. Most of these increases would relate to environmental outcomes greater than one standard deviation different than current (see Table 4-26). Environmental outcomes for the other species would be stable. The outcome levels would be either "A", "B", or "C".

There would be a "good" likelihood of persistence of species within these seven families under all three alternatives, except for woodland caribou, lynx, and wolverine, because of the improving environmental outcomes, increasing extent of source habitats, improved distribution of habitats over the next 100 years, and improving habitat capacity. There would be a "poor" likelihood of persistence of woodland caribou over the next 100 years because of the small population size of the caribou and predation by cougars. Forest Service or BLM could do little through management of habitat to improve this likelihood, other than continuing to cooperate with the U.S. Fish and Wildlife Service and state wildlife management agencies to facilitate recovery of woodland caribou (see Threatened and Endangered Species section). There would be a "fair" likelihood of persistence for lynx because of their small population size and potential competition with other predators, and for wolverine because of small population size and unaccounted-for human disturbance near denning sites. Adverse effects of human-related activities on these two species should be reduced

Table 4-24. Percent of Watersheds or Subwatersheds[1] with 50 Percent or More Forest Service- or BLM-administered Lands with a High Environmental Index or with Either a High or Low Environmental Index (Total), by Species Current and by Alternative at 100 years.

Species	Class[2]	Current	Alternative S1	Alternative S2	Alternative S3
			Percent of Total Range		
Family 1					
pygmy nuthatch	High	5	8	13	12
	Total	53	93	93	93
Lewis' woodpecker	High	5	5	10	9
	Total	35	90	91	91
Family 2					
American marten	High	23	50	51	51
	Total	70	99	99	99
flammulated owl	High	7	13	18	18
	Total	59	98	98	98
northern goshawk (summer)	High	15	32	39	38
	Total	62	98	98	98
hoary bat	High	16	29	36	35
	Total	83	99	99	99
black-backed woodpecker	High	22	41	49	48
	Total	62	99	99	99
woodland caribou	High	34	97	95	95
	Total	51	98	98	97
Family 3					
blue grouse (summer)	High	35	68	65	65
	Total	89	100	100	100
lynx	High	69	69	69	69
	Total	100	100	100	100
wolverine	High	34	41	41	41
	Total	100	100	100	100
Family 4					
Lazuli bunting	High	38	60	57	58
	Total	68	96	96	96
Family 5					
gray wolf	High	3	2	3	3
	Total	99	99	99	99
grizzly bear	High	15	13	13	13
	Total	75	68	68	68
Rocky Mountain bighorn sheep (summer)	High	12	8	8	8
	Total	34	35	35	35
Rocky Mountain bighorn sheep (winter)	High	10	7	8	7
	Total	33	35	35	35
Family 6					
northern goshawk (winter)	High	27	56	60	60
	Total	67	97	97	97
rufous hummingbird	High	39	69	69	69
	Total	90	98	99	98
Family 7					
long-eared myotis	High	19	18	18	18
	Total	100	100	100	100
Family 8					
western bluebird	High	4	3	6	5
	Total	76	99	99	99
Family 9					
ash-throated flycatcher	High	78	78	75	75
	Total	81	86	82	83

Table 4-24. Percent of Watersheds or Subwatersheds[1] with 50 Percent or More Forest Service- or BLM-administered Lands with a High Environmental Index or with Either a High or Low Environmental Index (Total), by Species Current and by Alternative at 100 years. (continued)

Species	Class[2]	Current	Alternative S1	Alternative S2	Alternative S3
			Percent of Total Range		
Family 10					
striped whipsnake	High	47	37	18	18
	Total	98	97	96	96
short-eared owl	High	5	0	3	3
	Total	84	78	79	79
pronghorn	High	28	28	24	24
	Total	94	94	93	93
Washington ground squirrel	High	0	0	0	0
	Total	90	90	90	90
Family 11					
Brewer's sparrow	High	40	14	17	17
	Total	91	95	95	95
sage grouse (summer)	High	46	14	17	17
	Total	87	88	89	89
sage grouse (winter)	High	46	22	27	27
	Total	88	88	90	89
Family 12					
Columbian sharp-tailed grouse (summer)	High	6	1	2	2
	Total	75	72	71	71
grasshopper sparrow	High	2	0	0	0
	Total	69	55	59	58

[1] Grizzly bear, gray wolf, lynx, and wolverine percentages were calculated by watershed. Other species were calculated by subwatershed.

[2] High = watersheds or subwatersheds with a High environmental index; Total = watersheds or subwatersheds with either a High or a Low environmental index.

Source: Modified from Raphael et al. 1999.

with Alternatives S2 and S3 compared to Alternative S1, because of direction to minimize or mitigate adverse effects of management actions on wide-ranging carnivores and to facilitate development of broad-scale habitat linkages.

The likelihood of persistence for species in all seven Terrestrial Families is predicted to be similar with all three alternatives. However, as previously stated, it is felt that Alternative S2 followed closely by Alternative S3 include specific direction that would improve habitat conditions to a greater extent than Alternative S1.

Stable or Slightly Decreasing Trends: Mixed Habitats

Habitat conditions for species in Terrestrial Families 5, 7, and 10 are predicted to be stable or decrease slightly. Species in these Families all depend on a mix of forest, woodland, and rangeland source habitat. The landscape modeling results indicate that over the next 100 years, total source habitats on BLM- and Forest Service-administered lands generally would be stable or decrease slightly for species in these Families (see Table 4-23). Total source habitat would, in most cases, equal or exceed 85 percent of historical levels, except for bighorn sheep and Washington ground squirrel. All alternatives generally would lead to similar amounts of total source habitats.

Alternative S1 is projected to provide slightly more source habitat (one to two percent) for bighorn sheep than Alternatives S2 or S3. It appears that this increase is due to a higher amount of early seral forest in Alternative S1. As mentioned previously, Alternative S1 takes a passive approach at managing mid seral forest and protecting late seral forest, while Alternatives S2 and S3 place emphasis on reducing risk of crown fires in mid seral forests, protecting late

Table 4-25. Current and Predicted Habitat Capacity, by Species and Alternative, for Watersheds or Subwatersheds[1] with 50 Percent or More Forest Service- or BLM-administered Lands and on All Lands within the Project Area.

Species	FS/BLM Lands				Cumulative-All Lands			
	Current	Alt. S1	Alt. S2	Alt. S3	Current	Alt. S1	Alt. S2	Alt. S3
	Percent of Historical							
Family 1								
pygmy nuthatch	30	45	50	49	20	36	39	38
Lewis' woodpecker (migrant)	19	37	45	43	14	29	34	33
Family 2								
American marten	56	89	90	90	48	77	79	79
flammulated owl	34	49	53	52	26	41	44	43
northern goshawk (summer)	51	85	92	91	44	66	70	70
hoary bat	54	71	76	75	52	56	59	59
black-backed woodpecker	47	73	85	83	40	63	73	71
woodland caribou	53	107	108	107	50	106	106	106
Family 3								
blue grouse (summer)	77	102	101	100	78	101	100	100
lynx	90	86	87	86	86	82	83	83
wolverine	59	65	66	65	54	57	57	58
Family 4								
Lazuli bunting	62	92	94	93	55	90	93	92
Family 5								
gray wolf	32	31	31	31	25	24	24	24
grizzly bear	36	32	32	32	25	22	22	22
Rocky Mountain bighorn sheep (summer)	57	59	60	60	49	52	53	53
Rocky Mountain bighorn sheep (winter)	53	59	60	60	47	52	52	52
Family 6								
rufous hummingbird	74	98	99	99	68	95	96	96
northern goshawk (winter)	71	107	110	110	72	108	109	109
Family 7								
long-eared myotis	63	58	60	59	55	51	52	52
Family 8								
western bluebird	49	58	62	61	38	44	46	45
Family 9								
ash-throated flycatcher	106	110	106	107	122	119	117	117
Family 10								
pronghorn	58	57	55	55	53	52	51	51
short-eared owl	41	35	36	36	27	26	26	26
striped whipsnake	84	75	63	63	76	68	60	60
Washington ground squirrel	27	24	27	25	14	15	14	14
Family 11								
Brewer's sparrow	60	36	40	39	45	29	30	30
sage grouse (summer)	47	26	30	29	34	20	22	22
sage grouse (winter)	46	36	41	40	34	27	30	29
Family 12								
Columbian sharp-tailed grouse (summer)	33	26	26	26	19	17	17	17
grasshopper sparrow	33	14	15	15	18	10	11	10

Abbreviations used in this table:
FS = Forest Service
BLM = Bureau of Land Management
Alt. = Alternative

[1] Grizzly bear, gray wolf, lynx, and wolverine percentages were calculated by watershed. Other species were calculated by subwatershed.

Source: Raphael et al. 1999.

Table 4-26. Current and Predicted Environmental Outcomes on Watersheds or Subwatersheds[1] with 50 Percent or More Forest Service- and BLM- administered Lands, and Current and Predicted Population Outcomes on All Lands, by Species and Alternative.

Species	FS/BLM Lands				Cumulative-All Lands			
	Current	Alt. S1	Alt. S2	Alt. S3	Current	Alt. S1	Alt. S2	Alt. S3
Family 1								
pygmy nuthatch	D	C[2]	C[2]	C[2]	D	C[2]	C[2]	C[2]
Lewis' woodpecker (migrant)	E	C[3]	C[3]	C[3]	E	C[3]	C[3]	C[3]
Family 2								
American marten	D	B[3]	B[3]	B[3]	D	C[2]	C[2]	C[2]
flammulated owl	D	C[2]	C[2]	C[2]	D	C[2]	C[2]	C[2]
northern goshawk (summer)	C	A[3]	A[3]	A[3]	C	B[2]	B[2]	B[2]
hoary bat	C	B	B	B	C	C	C	C
black-backed woodpecker	C	B[2]	A[3, 4]	A[3, 4]	C	B[2]	B[2]	B[2]
woodland caribou	D	B[3]	B[3]	B[3]	E	D[3]	D[3]	D[3]
Family 3								
blue grouse (summer)	B	A[2]	A[2]	A[2]	B	A[2]	A[2]	A[2]
lynx	A	A	A	A	C	C	C	C
wolverine	C	B	B	B	D	D	D	D
Family 4								
Lazuli bunting	C	A[3]	A[3]	A[3]	D	A[3]	A[3]	A[3]
Family 5								
gray wolf	C	C	C	C	D	D	D	D
grizzly bear	C	D[2]	D[2]	D[2]	E	E	E	E
Rocky Mountain bighorn sheep (summer)	C	C	C	C	E	E	E	E
Rocky Mountain bighorn sheep (winter)	D	C[2]	C[2]	C[2]	E	E	E	E
Family 6								
rufous hummingbird	B	A[2]	A[2]	A[2]	B	A[2]	A[2]	A[2]
northern goshawk (winter)	B	A[2]	A[2]	A[2]	B	A[2]	A[2]	A[2]
Family 7								
long-eared myotis	B	C	B	C	C	C	C	C
Family 8								
western bluebird	C	C	B	B	C	C	C	C
Family 9								
ash-throated flycatcher	B	B	B	B	B	B	B	B
Family 10								
pronghorn	C	C	C	C	C	C	C	C
short-eared owl	C	C	C	C	D	D	D	D
striped whipsnake	A	B[2]	B[2]	B[2]	B	B	B	B
Washington ground squirrel	C	C	C	C	E	E	E	E
Family 11								
Brewer's sparrow	B	C[2]	C	C[2]	C	C	C	C
sage grouse (summer)	C	D	D	D	D	D	D	D
sage grouse (winter)	C	D	C	C	D	D	D	D
Family 12								
Columbian sharp-tailed grouse (summer)	D	D	D	D	E	E	E	E
grasshopper sparrow	D	E	E	E	E	E	E	E

Abbreviations used in this table:
FS = Forest Service
BLM = Bureau of Land Management
Alt. = Alternative

[1] Grizzly bear, gray wolf, lynx, and wolverine percentages were calculated by watershed. Other species were calculated by subwatershed.
[2] Expected values are greater than one standard deviation different from current.
[3] Expected values are greater than two standard deviations from current.
[4] Expected values are greater than one standard deviation from Alternative S1.

Source: Modified from Raphael et al. 1999.

seral forests, restoring early seral conditions that were created through past logging, and restoring mid seral forests that were created through fire exclusion. This difference in focus results in a slightly higher level of early seral forest under Alternative S1. However, the early seral forest of Alternatives S2 and S3 would be more similar in composition and structure to habitats that existed historically and would be more likely to be sustained than would the early seral forest conditions in Alternative S1. Thus, the habitat in Alternatives S2 and S3 would likely be of higher quality than that of Alternative S1. Since there is no difference in the environmental outcomes among the alternatives for this species (Table 4-26), the differences in amount of source habitat among alternatives represent local (among watersheds) effects compared to basin-wide effects on Forest Service- and BLM-administered lands.

Also, Alternative S1 is projected to provide slightly more source habitat (five percent) for striped whipsnake than Alternatives S2 or S3. One of the primary differences in habitats for this species for all alternatives is change in woodland cover types. Management direction intended to provide benefits for multiple species in Alternatives S2 and S3 is aimed at halting the encroachment of woodlands, especially juniper woodlands, on sites where woodlands did not occur historically. The increased vulnerability of these cover types to wildfire, induced through fine fuel buildup as livestock grazing decreases, is evident in all alternatives by the increases projected in wildfire occurrence within these types. These woodland cover types remain, or even increase, with Alternative S1, because it is passive on the issue of woodland encroachment. However, the amount of this source habitat type is projected to remain abundant with all alternatives. The woodland source habitat that is conserved or restored with Alternatives S2 or S3 is likely to be of higher quality than with Alternative S1. Since there is no difference in the environmental outcomes among the alternatives for this species (Table 4-26), the differences in amount of source habitat among alternatives represent local (among watersheds) effects compared to basin-wide effects on Forest Service- and BLM-administered lands.

Furthermore, Alternative S1 is projected to provide slightly more source habitat (one to five percent) for short-eared owl, striped whipsnake, Washington ground squirrel, and pronghorn than Alternatives S2 or S3. Implementation of Alternatives S2 and S3 would emphasize transitioning to native herbland or open or closed canopy shrublands and away from non-native bunchgrasses through wildfire suppression in high-risk areas, passive restoration, and changes in grazing systems, which would likely lead to reduction of livestock grazing in the first decade. The ecological interactions that occur in these systems are complex and are more complicated than described here. The direction in Alternatives S2 and S3 is designed to more actively prevent the spread of non-native vegetation and to produce more sustainable habitats. Where rangeland source habitats reflect a higher outcome under Alternative S1, it generally would be a result of the interaction of livestock grazing, wildfire, flammable exotics (annual grasses such as cheatgrass), and woody fuels. The projected declines in livestock grazing are expected to provide beneficial environmental effects. However, the higher level of decreases in livestock grazing expected in some areas with Alternatives S2 and S3 would result in increased fine fuels (both native and non-native annual grasses) in the short term. The non-native grasses are more flammable and would triple the length of the wildfire season compared to native perennial grasses. These increases in fuels and flammability are expected to result in more wildfire, that in turn are expected to change cover types, structural stages, and susceptibility to exotic invasions in specific areas and thus reduce source habitat for these species. Advances in restoration technology and available resources for aggressive active restoration of the dry rangelands would have to be applied at higher levels than what was modeled to sustain the native habitats produced for these species with Alternatives S2 and S3. Since there is no difference in the environmental outcomes among the alternatives for these species (Table 4-26), the differences in amount of source habitat among alternatives represent local (among watersheds) effects compared to basin-wide effects on Forest Service- and BLM-administered lands.

The number of areas with a high or low environmental index of source habitats for species in these three Families generally would be stable or would slightly decrease on Forest Service- and BLM-administered lands to a similar degree with all alternatives. Generally there would be stable levels or slight reductions in the percentage of subwatersheds with predicted high or low environmental index (see Table 4-24) indicating the geographic extent of habitat would be maintained. The percentage of subwatersheds with a high environmental index generally would be reduced from current to a similar degree in all alternatives. The repatterning of vegetation in Alternatives S2 and S3 should improve connectivity and make the increases in number of areas with a high or low environmental index more sustainable.

The habitat capacity on BLM- and Forest Service-administered lands would be stable or would decrease for the species in these three Families (see Table 4-25), compared to current levels, except for bighorn sheep, which would increase slightly. The

EIS Team concluded that there may be better improvement in livestock management with Alternatives S2 and S3 compared to Alternative S1, which could improve the habitat capacity under these alternatives compared to Alternative S1 for Family 10. The EIS Team also concluded that values might also be higher with Alternatives S2 and S3 for gray wolf and grizzly bear, because direction for wide-ranging carnivores to minimize and mitigate adverse effects of management and develop broad-scale linkages is not reflected in modeled results. Moderate and high grazing effects continue to would con-tribute to lower habitat capacity values for Family 10.

In summary, habitat conditions on BLM- and Forest Service-administered lands for the species in Terrestrial Families 5, 7, and 10 would remain stable or would slightly decrease over the next 100 years under all three alternatives. Model predictions of the environmental outcomes for species in these Families do not vary among alternatives by greater than one standard deviation at the basin-wide scale (see Table 4-26). Alternatives S2 and Alternative S3 include specific direction to restore habitats that have declined substantially in geographic extent from the historical to the current period, maintain and recruit snags, repattern vegetation consistent with the landscape, use the Healthy Rangelands strategies throughout the project area, reduce exotic plant invasion through Integrated Weed Management, and reduce roads. Therefore, both would slow succession momentum and the declines in habitat condition to a greater extent than Alternative S1. The predicted trends in environmental outcomes on Forest Service- and BLM-administered lands for species in these Families would be stable for six of nine species with Alternative S2, and for five of nine species with Alternative S1 and S3 (see Table 4-26). The environmental outcome levels would be either "B", or "C", except for grizzly bear which would have a predicted outcome of "D". The environmental outcome for striped whipsnake and grizzly bear decrease with all alternatives and the outcome for long-eared myotis decreases with Alternatives S1 and S3. Rocky Mountain bighorn sheep (winter) increase one outcome class with all alternatives. The outcome class changes for grizzly bear, bighorn sheep (winter), and striped whipsnake are greater than one standard deviation different than current.

It is unlikely that the outcomes for gray wolf or grizzly bear would get much better. Social pressures would most likely restrict the distribution of these species to areas with sparse human populations. This limited distribution would limit the potential outcomes for these species. Recovery plans and post-recovery monitoring would be important in maintaining these outcomes (see the Threatened and Endangered Species section).

There would be a "fair" likelihood of persistence of species within these three Families under all three alternatives, except for the Washington ground squirrel, because of the following stable or slightly decreasing factors: (1) environmental outcomes, (2) amounts of source habitats, (3) distribution of habitats over the next 100 years, and (3) habitat capacity. Although the environmental outcome for Washington ground squirrel is predicted to be a "B", because of its small population size there would be a "poor" likelihood of persistence of this species over the next 100 years for all three alternatives. There would be little that the Forest Service or BLM can do to improve this likelihood at the broad-scale, because of the limited amounts of source habitat on Forest Service- or BLM-administered lands.

Stable or Decreasing Trends: Rangeland Habitats

Habitat conditions for species in Terrestrial Families 11 and 12 are predicted to be stable or decreasing. Species in these Terrestrial Families all depend on rangeland habitat. The landscape modeling results indicate that, for species in these Families, total source habitats on Forest Service- and BLM-administered lands would generally decrease over the next 100 years (see Table 4-23). Total source habitat would, in most cases, equal or exceed 65 percent of the historical level, except for grasshopper sparrow, which is predicted to be less than 40 percent of historical. For all alternatives, there would be a similar trend for the amounts of total source habitats, except source habitat for Columbia sharp-tailed grouse would increase slightly from current with Alternative S1.

Alternative S1 is projected to provide slightly more source habitat (five percent) for Columbian sharp-tailed grouse than Alternatives S2 or S3. As mentioned previously, implementation of Alternatives S2 and S3 would emphasize transitioning to native herbland or open or closed canopy shrublands and away from non-native bunchgrasses through wildfire suppression in high-risk areas, passive restoration, and changes in grazing systems, which will likely lead to reduction of livestock grazing in the first decade. The higher level of decreases in livestock grazing expected in some areas with Alternatives S2 and S3 would result in increased fine fuels (both native and non-native annual grasses) in the short term. These increases in fuels and flammability are expected to result in more wildfire that in turn, are expected to change cover types, structural stages, and susceptibility to exotic invasions in specific areas. Advances in restoration technology and available

resources for aggressive active restoration of the dry rangelands would have to be applied at higher levels than what was modeled to sustain the native habitats produced for this species with Alternatives S2 and S3. Since there is no difference in the environmental outcomes among the alternatives for this species (Table 4-26), the differences in amount of source habitat among alternatives represent local (among watersheds) effects compared to basin-wide effects on Forest Service- and BLM-administered lands.

The number of areas with a high or low environmental index for species in these two Families would generally be stable or reduced (see Table 4-24,) indicating maintenance or a reduction in the extent of habitat. The percentage of subwatersheds with a high environmental index would generally be reduced similarly from current for all alternatives. The reduction is substantial for some species. The repatterning of vegetation in Alternatives S2 and S3 should improve connectivity and make remaining source habitat more sustainable.

The habitat capacity on BLM- and Forest Service-administered lands compared to current would decrease for the species in these two Families (see Table 4-25). The habitat capacity would generally be slightly higher with Alternatives S2 and S3 than with Alternative S1, even though alternative S1 is predicted to provide greater amounts of source habitats for one species. This is because Alternatives S2 and S3 with active restoration would do a better job at slowing successional momentum and reductions in habitat quality than would Alternative S1. As discussed previously, the EIS Team concluded that there may be more improvement in livestock management with Alternatives S2 and S3, which could improve the habitat capacity for species in these two Families with these alternatives compared to Alternative S1. Moderate and high grazing effects would continue to contribute to lower habitat capacity for Families 11 and 12.

In summary, habitat conditions for the species in Terrestrial Families 11 and 12 would be stable or would decrease over the next 100 years under all three alternatives. Model predictions of the environmental outcomes for species in these Families do not vary between alternatives by greater than one standard deviation at the basin-wide scale (see Table 4-26). It is felt that Alternative S2 followed closely by Alternative S3, would slow both succession momentum and the declines in habitat conditions to a greater extent than Alternative S1. These two alternatives include specific direction to restore habitats that have declined substantially in geographic extent from the historical to the current period, repattern vegetation consistent with the landscape, use the Healthy Rangelands strategies throughout the project area, reduce exotic plant invasion through Integrated Weed Management, and reduce roads. The predicted trends in environmental outcomes on Forest Service- and BLM-administered lands for species modeled in these Families would decrease for three of five species with Alternatives S2 and S3, and would decrease for four of five species with Alternative S1 (see Table 4-26). The outcome levels would be either "C", "D", or "E". Of these, only the change for Brewer's sparrow with Alternatives S1 and S3 would be greater than one standard deviation different from current and Alternative S2.

There would be a "fair" to "poor" likelihood of persistence of species within these two Families under all three alternatives, because of the following stable or decreasing factors: (1) environmental outcomes, (2) amounts of source habitats, (3) distribution of habitats over the next 100 years, and (4) habitat capacity. In some cases the "poor" likelihoods result from the inability of alternatives to reverse the momentum of vegetative succession, and habitat conditions would continue to worsen for these species. As mentioned previously, implementation of the alternatives would slow successional momentum to varying degrees. Alternative S2, followed closely by Alternative S3, includes specific direction that would slow declines in habitat conditions to a greater extent than Alternative S1.

The likelihood of persistence ratings for the species in these families are as follows. The predicted decreases in habitat are of concern, but because of the predicted environmental outcome of "C" the Brewer's sparrow was given a "fair" rating for all alternatives, and there would be less risk to persistence with Alternative S2. Predicted low habitat capacities and low environmental outcomes caused sage grouse (summer) and grasshopper sparrow to be given a "poor" likelihood of persistence for all alternatives. The likelihood also would be "poor" for Columbian sharp-tailed grouse because of a low habitat capacity as a percent of historical capacity, and small, disjunct populations.

Cumulative Effects (All Lands)

The effects of activities predicted to occur on lands not administered by the BLM and Forest Service would affect species in the Terrestrial Families similarly with implementation of any of the alternatives. The habitat capacity for all lands would increase for about 55 percent of the species modeled, and decrease for about 45 percent (see Table 4-25). The habitat capacity would generally be less on all lands than on BLM- and Forest Service-administered

lands primarily because of the greater effect of human activities on private lands.

For all alternatives, the predicted population outcome classes would improve from current for 11 species-seasonal combinations and would remain stable for 19 species-seasonal combinations. The number of species-seasonal combinations with predicted outcomes of "A", "B", "C", "D", or "E", would be 4, 4, 10, 6, and 6, respectively (see Table 4-26). The continued predicted outcome of "E" for six species-seasonal combinations: grizzly bear, Rocky Mountain bighorn sheep (summer and winter), Washington ground squirrel, Columbian sharp-tailed grouse, and grasshopper sparrow indicate a strong potential for extirpations. Aggressive actions, such as outlined in recovery plans and associated documents for grizzly bear and the reintroductions which have occurred for bighorn sheep, will be necessary to avoid such extirpations.

Terrestrial Riparian and Wetland Species

Methodology: How Effects on Terrestrial Riparian and Wetland Species were Estimated

The nature of the broad-scale data used for analysis of the alternatives precluded detailed analysis of riparian and wetland conditions. No comprehensive wetlands inventory is available for the basin. Consistent basin-wide data were not available for amount of riparian habitat within subwatersheds or for condition of that habitat. Because of these limitations the effects of the alternatives on Forest Service- and BLM-administered lands were qualitatively described based on expected effects of implementing the alternatives on riparian and wetland resources.

In addition, results from the aquatic habitat capacity model are presented to provide an indication of the degree of the difference among alternatives on Forest Service- and BLM-administered lands. This model was used by SAG to describe effects on aquatic species (see Aquatic–Riparian–Hydrologic Component section, later in this chapter). However, it is believed that predictions from this model can show trends in habitat of riparian-dependent terrestrial species whose habitat factors, such as water quality and riparian vegetative cover, are also important to aquatic species.

Cumulative effects on all lands use qualitative discussions and model predictions. Models to predict effects on terrestrial riparian and wetland species across the project area were based solely on upland landscape proxies, and no attempt was made to model actual amounts of riparian or wetland habitat (Raphael et al. 1999).

Effects of the Alternatives on Terrestrial Riparian and Wetland Species

As discussed in Chapter 2, riparian and wetland habitats are fine-scale and, for the most part, cannot be identified with the broad-scale vegetation data used by this project. Therefore, only the following general broad-scale issues have been identified for riparian and wetland habitats:

- Riparian or wetland areas have been degraded from activities such as grazing, recreation, timber harvest and roads.
- The introduction of exotic plant and animal species has adversely affected riparian and wetland habitats and species.
- Dams and their operation have altered flow regimes and negatively affected riparian habitat; many riparian shrub habitats have declined because of overgrazing and fire exclusion.
- Levels of snags and downed wood have been adversely affected by timber harvest and fuelwood gathering.

For more details on effects of the alternatives on riparian habitats, also see the Aquatic–Riparian–Hydrologic Component section, later in this chapter, and Raphael et al. (1999).

General Effects

As discussed in Chapter 2 and in the methods section, it is not possible to analyze specific effects of the alternatives on terrestrial riparian or wetland species. It is possible to estimate the general effects that implementation of the alternatives would have on these species. These general effects are presented in the following paragraphs.

Slowing the Decline of Rangeland Terrestrial Habitats: Options Considered

Within the overall framework of the Supplemental Draft EIS alternatives, various options to further slow the decline of rangeland terrestrial habitats have been explored or analyzed to varying levels. Generally, these options deal with increasing specificity of broad-scale direction as opposed to allowing flexibility for adapting solutions to meet local conditions through the step-down process. The following descriptions are intended to provide a brief overview of the direction and approach currently existing in the Supplemental Draft EIS contrasted with an overview of the options that have been considered and might be further explored up through the Record of Decision.

1. **Apply broad-scale restoration priority to more subbasins dominated by rangeland habitats.**

   A set of rangeland subbasins has been included in the 40 high restoration priority subbasins of Alternative S2 and the 51 high restoration subbasins of Alternative S3. A preliminary evaluation explored effects from the option of adding 8 to 20 more rangeland habitat subbasins to the high restoration priority list of subbasins. This analysis was limited to a few key species of concern and their associated habitats. The effects suggested that it is possible to improve conditions when restoration is an emphasis on rangeland settings. This analysis did not find that basin-wide population outcomes shifted significantly as a result of the additional investment in restoration. The full level and extent of restoration required to generate a basin-wide shift in population outcomes by a whole category was not fully defined. However, the degree of change in restoration investments and/or management actions would be substantial, and the tradeoffs essential to undertake such a shift were not explored in depth. It would likely mean a shift in restoration resources away from the forested and aquatic environments. The consequences on these other environments may be substantial.

   Improving rangeland conditions is generally an expensive and long-term process. Applying priority to all the rangeland-dominated subbasins would likely detract from the beneficial effects of treatments applied in other settings within the project area. Whether a different specific set of rangeland subbasins might be emphasized to improve conditions and still be within acceptable cost boundaries was not explored beyond what has been described above. Alternatives S2 and S3 include direction intended to improve habitat conditions in rangeland areas for species of concern. Thus it is possible to put more specific emphasis on where and how this might be accomplished and still be within the overall framework of the Supplemental Draft EIS alternatives. The implication would be to provide more prioritization up-front as opposed to allowing the step-down process to drive the priorities and potential actions.

2. **At the broad scale, specify very large reductions in livestock stocking rates as a low cost means of improving condition of rangeland habitats.**

   Current direction in the Supplemental Draft EIS states that land uses such as livestock grazing should provide for maintenance and the opportunity for restoration of terrestrial source habitat. This is believed to be the direction appropriate at the broad scale. Because of the highly variable rangeland conditions, the extent of restoration and change in livestock grazing rates would be determined through locally driven management analyses and plans. The amount of change in stocking rates would vary locally depending on what was necessary to achieve this and other broad-scale objectives in the Supplemental Draft EIS for rangeland habitats.

   Specifying major reductions in livestock grazing across large areas would change the effects projected under Alternative S2 and/or Alternative S3. To project the specific effects of this option would be a substantial modeling effort. The extent to which this might contribute to substantial improvements in rangeland habitat trends is unknown, but it would likely be variable depending on conditions within specific habitat types and landscapes. While this option is "low cost" to the federal agencies, it may have social and economic consequences affecting livestock operators and rural agriculturally based communities. The tradeoffs would need to be fully disclosed.

3. **At the broad scale, specifically identify changes in livestock management which would be implemented to improve condition of rangeland habitats.**

   Option 2 above addressed substantial reductions in livestock grazing. Option 3 is focused on the components of grazing management strategies such as riding, herding, salting, season of use, class of livestock, and grazing systems. Again, current direction in the Supplemental Draft EIS states that these components should be addressed and modified as necessary at the local level to maintain and restore terrestrial source habitat consistent with broad-scale objectives. Because of the high variability in rangeland conditions and grazing allotments, the precise strategies were not specified at the broad-scale.

   The specific effects of this option have not been evaluated. Whether a set of specific changes in livestock management would show improved conditions in rangeland habitats requires more analyses. Providing more definition to where and how changes might be undertaken specifically to improve rangeland habitat conditions may prove beneficial for some species habitats. The question remains, however, as to whether it is appropriate or even feasible with broad-scale information to provide this level of fine-scale direction with enough certainty at the broad scale to actually benefit the rangeland species of concern.

Options (continued)

4. **At the broad scale, specify reduction of road density classes to low, very low, or none across large rangeland areas.**

   Current direction in Alternatives S2 and S3 is to complete a roads analysis that results in providing human access while minimizing risk to resources (such as terrestrial species). This direction provides through the step-down process the ability to address terrestrial species needs and the potential to reduce adverse effects of roads.

   A preliminary evaluation was undertaken on the option of specifying reductions in road density class at the broad scale. Where density classes were reduced to 0.7 miles of road per square mile or less (the low road density class), the effect on most species modeled did not result in a shift of a whole population outcome category. A benefit associated with road reductions could be a slower rate of spread of exotic vegetation. However, predicting the effects of such a change in road densities in the rangeland setting would involve more analyses.

   The general landforms and vegetation on rangelands make it difficult to restrict vehicle travel on many landscapes. Removing roads in these situations might not be as effective as removing roads in the forested environment. Thus, predicting outcomes from road reductions is more complicated in the rangeland setting. The issue is really about the management of human access to these settings, not just the presence of roads.

5. **At the broad scale, designate a network of habitats for conservation of terrestrial species.**

   The intent of Alternatives S2 and S3 is to maintain and restore rangeland habitats. This is accomplished by the identification of high restoration priority subbasins, identification of T watersheds, and direction to increase source habitats that have declined substantially in geographic extent from the historical to the current period throughout the basin, so that, through time, a well-distributed network of habitats exists. No concerted effort has been undertaken at the broad scale to define a specific network of habitats for terrestrial species of concern. The wide-ranging species under consideration here might result in a designated network of habitats for terrestrial species that would include most of the BLM- and Forest Service- administered lands in the project area. A network with such a broad definition would not likely contribute to conservation management for the species of concern.

   The option of developing a restricted network focused on specific habitats for species of rangeland concern would require additional analysis. The potential benefit that such a designation might have on outcomes for species and their habitats is not known. Although it is unknown how much such a designation might improve habitat conditions through the emphasis such a network would provide, it is unlikely that the designation itself would reverse major trends for these species.

6. **At the broad scale, add specificity to management practices to be used in high restoration priority subbasins.**

   The current direction requires accelerated step-down analysis, both Subbasin Review and Ecosystem Analysis at the Watershed Scale (EAWS), in the high restoration priority subbasins to assist in the planning and designing of management activities to meet the broad-scale Supplemental Draft EIS objectives and address local resource conditions and issues.

   This option is a combination of options 1, 2, and 3 defined above. It may be possible to define more broadly a limited set of specific actions that would focus on specific rangeland species habitats. The highly variable conditions across the subbasins, however, would create a need for different mixes of practices and emphases. The degree to which this is both desirable and possible is not known at this time.

7. **At the broad scale, adopt a specific timeline for completion of rangeland grazing allotment analysis.**

   The BLM has adopted a rapid rangeland assessment process to be completed during a 10-year period. The Forest Service has not committed to such a process but has stated the intent to undertake rangeland assessments as part of their overall rangeland management efforts. The Supplemental Draft EIS does not presently include a specific timeline for completion of allotment analyses. The degree to which this might contribute to improved habitats in the rangeland as is not known.

8. **Identify areas that are functioning but at risk and could be prioritized for changes in livestock management or restoration/maintenance.**

   Current direction in Alternatives S2 and S3 states that areas that are functioning at risk because of livestock grazing management and that would be responsive to treatment, are high priority to initiate changes to livestock management.

   Some lands are still functioning much as they would in a native, undisturbed state yet are at risk of transitioning to a non-functional state. This is an inventory issue, as insufficient information is available now to geographically identify and designate these rangeland areas that would respond to restoration. Currently, this inventory is addressed within the step-down processes that link broad-scale direction to specific project decisions. It is possible to undertake an effort with field biologists and range conservationists to define these areas with more detail. The outcome could help define where priority for restoration investment might be undertaken. The issues related to this are similar to those shown under Options 1 and 6 above. This inventory could strengthen implementation of the existing direction. No new direction would have to be added to the Supplemental Draft EIS to implement the inventory.

Options (continued)

9. **Increase funding to improve fire management and/or to assure rehabilitation following wildfire events.**

   The issues surrounding this option are subsets of issues generally addressed in Option 1 above. These are potential ways to manifest a restoration emphasis.

10. **At the broad scale, specifically identify actions to reduce human uses that would be implemented to improve condition of range habitats.**

    In addition to the objectives and standards that address management activities and human uses, current direction in Alternatives S2 and S3 is to reduce the negative effects of human disturbance through assessment of risks and opportunities during step-down processes.

    The issues surrounding this option are generally addressed in Option 4 above. The potential improved rangeland habitat conditions from road reductions include the beneficial aspects of limited or reduced human access and uses. This option includes more than simply removing roads, however; it also addresses the issues associated with off-road vehicle uses, hunting, fishing, recreation, and other uses. Given the variability of terrain, current conditions of the landscape, and uses across the project area, the step-down process has been determined to this point to be the appropriate strategy for addressing these issues.

Options Summary

All the options described above for improving habitats for rangeland species of concern were explored and discussed to varying degrees by the ESC. As noted, some changes in management direction were made. However, these options were not pursued further at this time for several reasons, including:

- The concern that alternatives must be developed that could be implemented within a realistic budget framework;
- The attempt to prioritize limited restoration funding to areas where current available science information indicated an opportunity to be successful;
- The emphasis on aquatic species and forest restoration issues and the unknown tradeoffs of shifting limited funding or priority away from these resources to rangelands; and
- The intent to provide broad-scale direction that clearly sets sideboards of what needs to be accomplished, yet leaves the decisions on how best to apply it to local decision makers through local analyses and public involvement.

Implementation of any of the alternatives should improve terrestrial riparian and wetland habitats. However, the riparian direction in Alternative S1 focuses on aquatic values, while Alternatives S2 and S3 addressed aquatic and riparian-dependent terrestrial species. For example, Alternative S1 contains direction to develop Riparian Management Objectives for aquatic species in riparian conservation areas (RCAs), and to manage subwatersheds with high aquatic species populations to maintain those populations. Although targeted for aquatic species these should have positive effects on habitat for terrestrial riparian species, through restoration of shrubs and other vegetation. In contrast, Alternatives S2 and S3 contain specific direction to: meet objectives for terrestrial riparian and wetland species in RCAs and to focus additional restoration activities in subbasins with good opportunities to improve terrestrial riparian and wetland habitats as well as direction similar to Alternative S1 to manage subwatersheds with high aquatic species populations to maintain those populations. Therefore, Alternatives S2 and S3 should have more positive effects on habitat for terrestrial riparian or wetlands species than Alternative S1. Results of the aquatic habitat capability model indicate that maintenance and restoration of riparian areas under Alternative S2 would be considerably better than with Alternative S1 or Alternative S3. Specific Watershed Condition Indicators for terrestrial riparian or wetland species and communities may not be completed for approximately two years following the ICBEMP Record of Decision. During this interim period, the lack of standard, measurable indicators of habitat condition will increase the risk that objectives to restore and/or maintain terrestrial riparian and wetland habitats may not be consistently achieved.

Management direction for riparian-dependent terrestrial species is more explicit, consistent, and comprehensive in Alternative S2, and, to a lesser extent Alternative S3, than in Alternative S1. More

uncertainty is associated with Alternative S1 because of inconsistent goals, objectives, and standards, especially on rangelands.

Habitats for wetland-dependent species could initially have less improvement than habitats for riparian-dependent species because interim RCA criteria related to wetlands is not as encompassing as it is for riparian areas. However, the interim RCA criteria would be revised during implementation of either Alternative S2 or Alternative S3 and this difference would likely be reduced.

Alternative S1 would reduce the spread of exotic plants through incorporation of noxious weed management into project and activity planning (see Factors of Influence section, later in this chapter). This should aid in maintenance and some restoration of riparian and wetland habitats, although to a lesser extent than Alternatives S2 or S3 which apply Integrated Weed Management and emphasize seeding with native species to reduce the spread of exotic plants. All alternatives would also limit the spread of exotic fish species, which should beneficially affect many amphibians.

All alternatives address water flow regimes to some degree, with greater clarity and consistency provided by the direction in Alternatives S2 and S3. This should benefit terrestrial species, especially those dependent on flood plain habitats.

As discussed previously, riparian and wetland habitats are generally too limited in extent to be identified using the broad-scale data. Where patch size of habitats are large enough to identify riparian or wetland habitats, Alternatives S2 or S3 should restore habitats that have declined substantially in geographic extent from the historical to the current period (shrub wetlands/open low-medium shrub, shrub wetlands/closed tall shrub, aspen/understory reinitiation, cottonwood-willow/understory reinitiation, cottonwood-willow/old multi-story forest) to a greater extent than Alternative S1. For most riparian and wetland habitats, however, Alternative S2 and to a somewhat lesser extent Alternative S3, focus on restoring networks of well-distributed, high quality habitats without specifying specific habitat restoration needs. It is anticipated that implementation of Alternatives S2 and S3 would result in restoration of shrub habitats to a greater extent than Alternative S1, although prediction of the exact amount of improvement is not possible.

Alternative S1 would provide levels of downed wood, but at levels below historical. Implementation of Alternative S1 should maintain or improve snag numbers in riparian areas, although to a lesser extent than with Alternatives S2 and S3. Alternatives S2 and S3 provide for the number, size, and species of snags and downed wood which can be sustained on a site on all Forest Service- and BLM-administered land within the project area. However, with Alternative S3 there would be less opportunity to adjust snag and downed wood numbers to fit local conditions, which could result in snag numbers, size, or species or downed wood outside the historical range. This could adversely affect riparian species locally.

Conclusions

Considering all the effects in combination, it appears likely that all alternatives would lead to improvement in terrestrial riparian condition over the next 100 years. The improvement in terrestrial riparian habitat in 100 years would be higher with Alternative S2 than with Alternatives S1 or S3. Alternative S2 would provide more opportunities for maintenance and restoration of riparian and wetland habitat because the extent of RCAs is greater than with Alternative S3. Compared to Alternative S1, Alternative S2 also provides more opportunities for maintenance and restoration of riparian and wetland habitat RCAs.

The differences in improvements between Alternatives S1 and S3 are less clear; Alternative S1 focuses on aquatic condition while direction in Alternative S3 includes more emphasis on riparian condition.

Generally, improving riparian and wetland conditions should improve the likelihood of persistence of riparian or wetland species. However, since specific effects can not be predicted at the basin scale because of data limitations, it is not possible to classify a relative level of likelihood of persistence.

Cumulative Effects

It is expected that on lands not administered by the Forest Service or BLM, riparian and wetland habitat condition would either be maintained or reduced. Reductions would adversely affect dependent species because of reduced connectivity.

Model predictions for terrestrial riparian and wetland species indicate at the basin level there would only be a slight reduction in riparian and wetland condition on all lands from current conditions. Most of the reduction in predicted riparian condition would be due primarily to increasing levels of HRV departure that is largely in wilderness and wilderness-like areas. These results indicate that basin-wide there would be little change in overall riparian or wetland condition over the next 100 years.

Special Status Terrestrial Species

Methodology: How Effects on Special Status Terrestrial Species were Estimated

This section presents the effects of the alternatives on species listed as threatened or endangered or proposed for listing under the Endangered Species Act (ESA), candidate species for listing under the ESA, and agency sensitive species. The effects which will be present were determined through methods already described in the plant, invertebrate, terrestrial vertebrate, and riparian and wetland species sections.

Effects of the Alternatives on Threatened, Endangered, or Proposed Species

Plants

As discussed previously, it is not possible to discuss specific effects of implementation of broad-scale direction on individual plant species. The effects on threatened or endangered plant species would be the same as previously described for plants of concern. Alternatives S2 and S3 provide for more improvement of ecosystem processes and functions, direct development of conservation strategies, and consistency with recovery plans. Thus, these alternatives should have a beneficial effect on listed, proposed, or candidate plant species. By these strategies, Alternatives S2 and S3 should reduce the potential for future listings. Alternative S1 does not propose changing current direction in various land use plans, which have had Endangered Species Act consultation competed and under which site-specific consultation is required on finer-scale project proposals. It is felt that this situation is best described as "not likely to adversely affect" listed or proposed species. However, it is doubtful that future listings would be prevented.

Riparian- and Wetland-dependent Species

Bald eagles and whooping cranes, which are listed, and the Columbia spotted frog and Oregon spotted frog, which are candidates for listing, are associated with riparian or wetland habitats. Bald eagles and the two species of spotted frog should be beneficially affected by implementation of any of the alternatives through general improvement of riparian habitats. The emphasis in Alternatives S2 and S3 on protecting large, old trees should benefit bald eagles, which occasionally nest in large trees in upland areas adjacent to rivers or lakes. Alternative S2 should have more beneficial effects than either Alternative S3 or Alternative S1 (see the Terrestrial Riparian and Wetland section for more information). There should be no effect on whooping cranes as records indicate they do not occur within the project area in western Montana, eastern Oregon, or eastern Washington where they are listed as endangered (see Chapter 2). Through improvement in riparian and wetland habitats there could be beneficial effects on the experimental population in Idaho; however, due the small numbers of whooping cranes and their limited distribution on Forest Service- and BLM-administered lands these benefits would be negligible.

Woodland Caribou

The woodland caribou, listed as endangered, was included in Terrestrial Family 2. Species in this Family depend on late seral, multi- and single storied montane forests as source habitat. Some also use late seral stages of subalpine or lower montane forests. Alternatives S2 and S3 would maintain and increase late seral, multi- and single storied montane and lower montane forests. The effects of the alternatives on woodland caribou were modeled by the SAG. There would be a substantial increase in the amount and distribution of source habitat for woodland caribou with all the alternatives, as well as substantial increases in the habitat capacity for this species. Woodland caribou should be beneficially affected by implementation of any of the alternatives (the environmental outcome would improve from a "D" to a "B" with all three alternatives). The primary limiting factor for woodland caribou would be small population size and predation by cougars. Predation factors could be influenced through cooperation with state

wildlife management agencies in population and habitat management plans for white-tailed deer and cougar. The Forest Service and BLM will need to continue to cooperate with the U.S. Fish and Wildlife Service and state wildlife management agencies to facilitate woodland caribou recovery, recognizing, from a habitat management perspective, that other factors such as predation will affect recovery.

All alternatives would increase the amount of source habitat for woodland caribou to levels well above historical levels. However, there would be more source habitat produced for woodland caribou with Alternative S1 than with Alternatives S2 or S3. The intent of management direction in Alternatives S2 and S3 is to provide a mosaic of habitats that are similar to historical conditions. Alternative S1 would be less effective in transitioning multi-story old forest in the moist forest PVGs to single story stands. Implementation of Alternatives S2 and S3 would include more active management to transition these habitats to single story stands, which represent transitions toward a more historical and sustainable composition and structure of old-forest conditions. Moving from contiguous multi-story stands of shade tolerant species to a mosaic that more closely matches historical conditions, which includes single story stands of shade intolerant species (such as whitebark pine, ponderosa pine, or white pine) would require passing through a growth stage that is not included in the source habitat for the woodland caribou. The intent of management direction in Alternatives S2 and S3 is to benefit multiple species, and would shift some stands through this process, resulting in slightly less habitat for this species than with Alternative S1.

Gray Wolf

The gray wolf, listed as endangered in part of the project area and as a non-essential experimental population in part of the project area, was included in Terrestrial Family 5. Species in this Family use a broad range of forest, woodlands, and rangelands as source habitat. Gray wolf are primarily limited by non-habitat factors such as: conflicts on private lands, the presence of domestic livestock, and human-caused mortality, all of which are often linked to road access. The effects of alternative implementation on gray wolf were modeled.

It is unlikely that the outcomes for gray wolf will be much higher. Social pressures will most likely restrict the distribution of this species to areas with sparse human populations. This limited distribution will affect the potential outcomes for the species. Compliance with recovery plans and post-recovery monitoring will be important. The environmental outcome reflects conditions across the historical range of gray wolf on Forest Service- and BLM- administered lands. Recovery plans, other related documents, and individual land use plans provide finer-scale guidance to protect these species. The purpose of this finer-scale direction is to recover gray wolf populations. Within recovery areas wolves appear to be increasing and nearing recovery goals. Alternatives S2 and S3 and to a lesser extent Alternative S1 should have beneficial effects on gray wolf and contribute to recovery.

In all alternatives there would be a slight increase in the amount of source habitat. The distribution of source habitat would be similar to current with all the alternatives. The habitat capacity for gray wolf would slightly decrease with all alternatives.

Conflicts on private land could contribute to the decrease in habitat capacity. The environmental outcome would be "C" for all alternatives, which is the same as current. The alternatives would reduce adverse effects from roads and human disturbance, with reductions greater under Alternatives S2 and S3 than under Alternative S1. Alternatives S2 and S3 also contain direction to minimize or mitigate adverse effects of management actions on wide-ranging carnivores and to develop broad-scale habitat linkages. This direction, which the EIS Team concluded should have positive effects on the gray wolf, was not reflected in the model inputs.

Grizzly Bear

The grizzly bear, listed as threatened, was also included in Terrestrial Family 5. Grizzly bear are primarily limited by non-habitat factors such as: conflicts on private lands, the presence of domestic sheep, and human-caused mortality, all of which are often linked to road access. The effects of alternative implementation on grizzly bear were modeled by SAG.

It is unlikely that the outcomes for the grizzly bear will be much higher. Social pressure will most likely restrict the distribution of this species to areas with sparse human populations. This limited distribution will affect the potential outcomes for this species. Compliance with recovery plans and post-recovery monitoring will be important. The environmental outcome reflects conditions across the historical range of the grizzly bear on Forest Service- and BLM-administered lands. Recovery plans, other related documents, and individual land use plans provide finer-scale guidance to protect these species. The purpose of this finer-scale direction is to recover grizzly bear populations. Within the Northern Continental Divide and Yellowstone Recovery Areas, grizzly bears appear to be increasing and nearing recovery goals. (Note: The Yellowstone Recovery Area is outside the project area.) Alternatives S2 and S3, and to a lesser extent Alternative S1 should have beneficial effects on grizzly bears and contribute to recovery.

In all alternatives there would be a slight increase in the amount of source habitat. The distribution of source habitat would slightly decrease with all the alternatives. Whitebark pine nuts are a very important source of protein for grizzly bears. The extent of seed-producing whitebark pine trees is expected to decrease under all alternatives because of white pine blister rust (see Factors Influencing Health of Ecosystems section, later in this chapter). The predicted decrease is, to some degree, related to the limited ability to do restoration activities in A1 subwatersheds under Alternatives S2 and S3 and wilderness and wilderness-like areas under all alternatives. Many areas of whitebark pine are located in these areas.

There would be slightly more (one percent) source habitat produced for grizzly bear with Alternative S1 than with Alternatives S2 or S3. The intent of managment direction in Alternatives S2 and S3 is to provide a mosaic of habitats that are similar to historical conditions. Alternative S1 would be less effective in transitioning multi-story old forest in the moist forest PVGs to single story stands. Implementation of Alternatives S2 and S3 would include more active management to transition these habitats to single story stands, which represent transitions toward a more historical and sustainable composition and structure of old-forest conditions. Moving from contiguous multi-story stands of shade tolerant species to a mosaic that more closely matches historical conditions, which includes single story stands of shade intolerant species (such as whitebark pine, ponderosa pine, or white pine) would require passing through a growth stage that is not included in the source habitat for this species. The intent of management direction in Alternatives S2 and S3 is to benefit multiple species, and would shift some stands through this process, resulting in slightly less habitat for this species than with Alternative S1.

Habitat capacity for grizzly bears would slightly decrease with all alternatives. The primary factor affecting grizzly bears is from conflicts on private land. The environmental outcome would be "D" with all the alternatives, which is a decrease from the current level of "C". The alternatives would reduce adverse effects from roads and human disturbance on Forest Service- and BLM-administered lands, with reductions greater under Alternatives S2 and S3 than under Alternative S1. Alternatives S2 and S3 also contain direction to minimize or mitigate adverse effects of management actions on wide-ranging carnivores and to develop broad-scale habitat linkages. This direction, which the EIS Team concluded should have positive effects on the grizzly bear, was not reflected in the modeling inputs.

Northern Idaho Ground Squirrel

The northern subspecies of northern Idaho ground squirrel is proposed to be listed as threatened. Northern Idaho ground squirrel was included in Terrestrial Family 12, but it was not one of the species individually modeled for Supplemental Draft EIS effects. Species in Family 12 depend on rangeland habitat. Source habitat for this species is projected to improve under all alternatives. However, populations of this species are small, disjunct, and isolated, which poses the most significant challenge to future management. In addition, a variety of fine-scale habitat issues pose challenges to management, including the displacement of native habitat by exotic vegetation, fire suppression that has facilitated the encroachment of trees and shrubs on meadow habitat, and conversion of private lands to non-habitat.

The northern Idaho ground squirrel is best addressed at a finer scale because of its limited distribution. In addition, most habitat for the species is found on private land. However, implementation of all alternatives should have general beneficial effects on this species' habitat on Forest Service- and BLM-administered lands.

Lynx

Lynx, proposed to be listed as threatened, are included in Terrestrial Family 3. The effects of alternative implementation on lynx were modeled. There would be a slight decrease with all alternatives in the

amount of source habitat, although the amount would remain above historical levels. The distribution of source habitat on Forest Service- and BLM-administered lands would be similar to current with all the alternatives. The habitat capacity of Forest Service- and BLM-administered lands would slightly decrease with all alternatives. The environmental outcome on Forest Service- and BLM-administered lands would be "A" with all the alternatives, which is the same as current. Alternatives S2 and S3 contain direction to minimize or mitigate adverse effects of management actions on wide-ranging carnivores and to develop broad-scale habitat linkages. This direction, which the EIS Team concluded should have positive effects on lynx, was not reflected in the modeling inputs. On the other hand, coarse-scale habitat and environmental factors used in the model may not reflect finer-scale environmental requirements that potentially account for a large amount of variation in key lynx population characteristics. For example, within-stand characteristcs of habitat, such as understory stem density of trees, may strongly affect prey availability and hunting efficiency of lynx; such within-stand characteristics of lynx habitat either were not measured or were measured coarsely in the model. If such within-stand characteristics actually do explain a large amount of the variation in population characteristics of lynx, then the model predictions may be optimistic.

Lynx may be primarily limited by non-habitat factors such as: low population size and competition with other predators. Current knowledge about lynx population size, density, and distribution suggest that lynx are quite rare within the southern portion of the species' range in the lower 48 United States. Competition with coyotes, cougars, and other predators may have a strong effect on lynx. These factors may account for most variation in lynx population characteristics. If this is the case, habitat and other environmental factors beyond those associated with competition may have relatively weak influence on lynx population characteristics. The potential negative effects of competition with other predators and low population size were included in the population outcome model; however, the modeled relations may not reflect the true strength of these hypothesized negative effects. Consequently, the predicted population outcome of "C" for current conditions and for all alternatives on all lands may be optimistic. However, a population outcome of "C" is within the range of population outcomes suggested by current knowledge of the spatial structure of lynx populations in the U.S.

Broad-scale conditions for lynx should remain stable with Alternative S1. Overall, the best habitat conditions would be with Alternatives S2 and S3, both of which should be better than with Alternative S1. Alternatives S2 and S3 should have positive effects due to repatterning vegetation to be more sustainable, minimizing or mitigating adverse effects of management actions on wide-ranging carnivores, facilitating development of broad-scale habitat linkages, and reducing roads. It is possible that the emphasis on restoration with Alternatives S2 and S3 could adversely affect prey availability and hunting efficiency of lynx. However, most restoration efforts are directed at dry and moist forest PVGs, as opposed to the cold forest PVGs more commonly used by lynx. Also, an objective of restoration is to repattern vegetation to fit the landscape. Areas with high stem densities are within the HRV for cold forest and some higher elevation, moist forest PVGs. Therefore, the need to treat these areas to lower stem density from a repatterning standpoint may be minimal, which will reduce the potential for adverse effects. Finally, both Alternatives S2 and S3 contain direction to minimize or mitigate adverse effects from proposed activities on wide-ranging carnivores such as lynx. Therefore, overall, Alternatives S2 and S3 should have a beneficial effect on lynx at the broad scale. A determination of effects relative to specific project proposals will have to be made on a site-specific basis.

Washington Ground Squirrel

The Washington ground squirrel, a candidate species, was included in Terrestrial Family 10. Species in Terrestrial Family 10 use a variety of shrublands, herblands, and woodlands. Small and disjunct populations would continue to limit Washington ground squirrels. The effects of alternative implementation on this species were modeled. The amount of source habitat on Forest Service- and BLM-administered lands would slightly increase with all alternatives. However, the repatterning of vegetation in Alternatives S2 and S3 should improve connectivity and make the increases in source habitat more sustainable. Habitat capacity for this species is predicted to be stable (Alternative S2) or decreasing (Alternatives S1 and S3). The environmental outcome would remain at the current level of "C" under all alternatives. Less than two percent of the source habitat available for the Washington ground squirrel occurs on Forest Service- and BLM-administered lands; therefore, this species is best addressed at a finer scale. The population outcome of "E" on all lands is driven by loss of habitat due to conversion for agricultural purposes and human disturbance. These factors are expected to continue to limit Washington ground squirrel populations.

Effects of the Alternatives on Sensitive Species

More than 700 plant species have been identified by the Forest Service and BLM as sensitive. It is not possible to discuss specific effects of implementation of broad-scale direction on individual plant species. Broad-scale models cannot incorporate fine-scale effects.

Most of 333 plants of concern were also identified as agency sensitive species. The effects on these sensitive plant species would be the same as previously described for plants of concern; that is, these sensitive plants could decrease with implementation of Alternative S1, which could adversely affect them. However, agency policy is to evaluate effects of specific projects or activities on sensitive species, so the effect of Alternative S1 is best described as "not likely to adversely affect" these sensitive plant species. Alternatives S2 and S3 should have a beneficial effect on the sensitive plant species resulting in continuation of stable populations.

The other 370 plants which have been identified as sensitive by the agencies, but which were not identified as plants of broad-scale concern, are more appropriately analyzed through the step-down process, including site-specific NEPA analysis. The broad-scale direction in any of the alternatives should have a general beneficial effect or no effect on these species.

One hundred terrestrial vertebrate species, including the recently delisted peregrine falcon, are considered sensitive by the agencies. Forty-four of the terrestrial vertebrates identified as sensitive by the Forest Service or BLM were identified as broad-scale species of focus in Wisdom et al. (in press) and were included in one of the 12 Familes or 40 Groups (see Table 4-27). The effects on these species would generally be the same as those described in the Terrestrial Vertebrate section for the various Families.

There are 21 species included in Families 1, 2, 3, and 6. The effects for these species would be generally increasing amount of source habitat, increasing habitat capacity, and environmental outcomes of "A", "B', and "C". All alternatives should have beneficial effects on these 21 species. Effects would be best with Alternative S2, slightly less with Alternative S3, and least with Alternative S1.

There are 14 species in Families 5, 7, and 10. One other species, the black rosy finch, can be represented by species in Family 5. The effects on these species would be generally stable or slightly decreasing amount of source habitat, stable or slightly decreasing habitat capacity, and environmental outcomes of "B" and "C". Alternative S2 and Alternative S3 both would slow declines in habitat to a greater extent than Alternative S1.

There are eight species in Families 11 and 12. The effects for these species are generally stable or decreasing amount of source habitat, decreasing habitat capacity, and environmental outcomes of "C", "D", and "E". Alternatives S2 and S3 should have beneficial effects on these species as they slow the habitat declines caused by succession. Alternative S2 followed closely by Alternative S3 would slow declines in habitat to a greater extent than Alternative S1.

Twenty-eight of the terrestrial vertebrates identified as sensitive by the Forest Service or BLM were identified as fine-scale in Wisdom et al. (in press). Many of these species are associated with riparian or wetland habitats. Implementation of any of the alternatives should have general positive effects on riparian- or wetland-dependent species through general improvement of riparian habitats. Alternative S2 should have more beneficial effects than either Alternative S3 or Alternative S1 (see terrestrial riparian and wetland section for more information). For all these species, the effects of management activities are more appropriately analyzed through the step-down process, including site-specific NEPA analysis.

Another 28 of the terrestrial vertebrates identified as sensitive by the Forest Service or BLM were found (Lehmkuhl et al. 1997) to be secure at the basin scale or more appropriately analyzed at a finer scale. The effects of management activities are more appropriately analyzed through the step-down process, including site-specific NEPA analysis.

Table 4-27. Classification of Threatened, Endangered, Proposed, Candidate, or Sensitive Terrestrial Vertebrates into 'Families' of Species of Broad-scale Focus, Species of Fine-scale Focus, or Not of Concern, Basin Wide.

Species	Status	Family or Scale[1]
woodland caribou	Endangered	Family 2
gray wolf	Endangered	Family 5
grizzly bear	Threatened	Family 5
bald eagle	Threatened	fine scale
whooping crane	Endangered	no
canada lynx	Proposed Threatened	Family 3
northern Idaho ground squirrel	Proposed Threatened	Family 12
Washington ground squirrel	Candidate	Family 10
Columbia spotted frog	Candidate	fine scale
Oregon spotted frog	Candidate	fine scale
western gray squirrel	Sensitive	Family 1
Lewis' woodpecker	Sensitive	Family 1
white-headed woodpecker	Sensitive	Family 1
pygmy nuthatch	Sensitive	Family 1
Vaux's swift	Sensitive	Family 2
olive-sided flycatcher	Sensitive	Family 2
three-toed woodpecker	Sensitive	Family 2
black-backed woodpecker	Sensitive	Family 2
pileated woodpecker	Sensitive	Family 2
fisher	Sensitive	Family 2
flammulated owl	Sensitive	Family 2
great gray owl	Sensitive	Family 2
boreal owl	Sensitive	Family 2
northern goshawk	Sensitive	Family 2 and 6
Williamson's sapsucker	Sensitive	Family 2
Hammond's flycatcher	Sensitive	Family 2
mountain quail	Sensitive	Family 3
wolverine	Sensitive	Family 3
California wolverine	Sensitive	see wolverine
Preble's shrew	Sensitive	Family 3
California bighorn sheep	Sensitive	Family 5
black rosy finch	Sensitive	Group 39 (Family 5)
rufous hummingbird	Sensitive	Family 6
spotted bat	Sensitive	Family 7
Townsend's (Pacific, western) big-eared bat	Sensitive	Family 7
western small-footed myotis	Sensitive	Family 7
long-eared myotis	Sensitive	Family 7
fringed myotis	Sensitive	Family 7
long-legged myotis	Sensitive	Family 7
Yuma myotis	Sensitive	Family 7
Mojave black-collared lizard	Sensitive	Family 10
western ground snake	Sensitive	Family 10
longnose snake	Sensitive	Family 10
burrowing owl	Sensitive	Family 10
ferruginous hawk	Sensitive	Family 10
kit fox	Sensitive	Family 11
pygmy rabbit	Sensitive	Family 11
Brewer's sparrow	Sensitive	Family 11
sage sparrow	Sensitive	Family 11
sage grouse	Sensitive	Family 11
loggerhead shrike	Sensitive	Family 11
Columbian sharp-tailed grouse	Sensitive	Family 12
grasshopper sparrow	Sensitive	Family 12
northern leopard frog	Sensitive	fine scale
tailed frog	Sensitive	fine scale
western toad	Sensitive	fine scale

Table 4-27. Classification of Threatened, Endangered, Proposed, Candidate, or Sensitive Terrestrial Vertebrates into 'Families' of Species of Broad-scale Focus, Species of Fine-scale Focus, or Not of Concern, Basin Wide.

Species	Status	Family or Scale[1]
Coeur d'Alene salamander	Sensitive	fine scale
Larch Mountain salamander	Sensitive	fine scale
painted turtle	Sensitive	fine scale
western pond turtle	Sensitive	fine scale
northern bog lemming	Sensitive	fine scale
common loon	Sensitive	fine scale
red-necked grebe	Sensitive	fine scale
trumpeter swan	Sensitive	fine scale
black tern	Sensitive	fine scale
harlequin duck	Sensitive	fine scale
yellow rail	Sensitive	fine scale
greater sandhill crane	Sensitive	fine scale
long-billed curlew	Sensitive	fine scale
upland sandpiper	Sensitive	fine scale
snowy plover	Sensitive	fine scale
red-naped woodpecker	Sensitive	fine scale
tricolored blackbird	Sensitive	fine scale
yellow-billed cuckoo	Sensitive	fine scale
American white pelican	Sensitive	fine scale
willow flycatcher	Sensitive	fine scale
yellow warbler	Sensitive	fine scale
Virginia's warbler	Sensitive	fine scale
Wilson's warbler	Sensitive	fine scale
bobolink	Sensitive	fine scale
veery	Sensitive	fine scale
northern red-legged frog	Sensitive	no
Cope's giant salamander	Sensitive	no
ringneck snake	Sensitive	no
dark kangaroo mouse	Sensitive	no
rock squirrel	Sensitive	no
prairie falcon	Sensitive	no
Swainson's hawk	Sensitive	no
northern harrier	Sensitive	no
hairy woodpecker	Sensitive	no
yellow-headed black bird	Sensitive	no
black-billed cuckoo	Sensitive	no
black swift	Sensitive	no
dusky flycatcher	Sensitive	no
northern pygmy owl	Sensitive	no
Cordilleran flycatcher	Sensitive	no
gray flycatcher	Sensitive	no
black-throated warbler	Sensitive	no
Townsend's warbler	Sensitive	no
MacGillivray's warbler	Sensitive	no
purple martin	Sensitive	no
solitary vireo	Sensitive	no
Scott's oriole	Sensitive	no
Swainson's thrush	Sensitive	no
Calliope hummingbird	Sensitive	no
green-tailed towhee	Sensitive	no
peregrine falcon	Sensitive	no
Acrtic peregrine falcon	Sensitive	see peregrine
wood frog	Sensitive	fine

[1] Family 1, 2, 3, etc = Terrestrial Families of species of broad-scale focus (Wisdom et al. in press); no = species not of concern basin-wide (Lehmkuhl et al. 1997); fine scale or fine = species more appropriately addressed at finer-scale (Wisdom et al. in press; Lehmkuhl et al. 1997).

Hunting, Viewing, and Collecting Considerations

Effects of the Alternatives on Hunting, Viewing, and Collecting Opportunities

This section presents the effects of the alternatives on hunting, viewing, and collecting of selected terrestrial species. Discussion of additional harvestability considerations specific to tribes is found in the Federal Responsibility and Tribal Rights and Interests section, later in this chapter.

Elk, Mule Deer, and White-tailed Deer

The capability of habitat to support elk, mule deer,and white-tailed deer was predicted by the SAG through models for all lands within a species range (Lehmkuhl and Kie 1999). Habitat capability is a measure of forage and cover habitat adjusted for qualitative effects of factors affecting habitat and factors affecting use of habitat.

The elk and mule deer model predictions indicate that under any of the alternatives, over the next 100 years, effects would be similar and most areas within the basin would have a stable to a modest increase in habitat capability. All areas of the basin would fall in the moderate category of habitat capability, except the northern portion of the Upper Columbia-Salmon Clearwater RAC, which would be in the high category. The northern portion of the Upper Columbia-Salmon Clearwater RAC would change one category by moving from moderate to high under all alternatives. The Butte, southern portion of the Upper Columbia-Salmon Clearwater, and the Eastern Washington RACs would improve from low to moderate habitat capability for elk and mule deer. In addition, for elk, the John Day-Snake River RAC and Yakima PAC would also improve from low to moderate habitat capability.

Based on this data, habitat capability would be available to continue to support elk and mule deer population levels similar to or slightly higher than current, although population numbers can be influenced by numerous factors other than habitat capability. Where habitat capability increases hunting opportunities could increase. However, it would be less likely that the potential increases in elk and mule deer numbers would keep pace with anticipated future demand as human populations increase in the basin. Therefore, because of non-habitat factors, hunting opportunities for elk and mule deer would likely be reduced from current over the next 100 years.

The white-tailed deer model predictions indicate that over the next 100 years under any of the alternatives, effects would be similar and many areas within the project area would have a stable to a modest increase in habitat capability. The John Day- Snake and Eastern Washington RACs would fall in the low category of habitat capability, while the Southeastern Oregon RAC and the northern portion of the Upper Columbia-Salmon-Clearwater RAC would be in the high category. All other areas would fall in the moderate category of habitat capability. The northern portion of the Upper Columbia-Salmon-Clearwater RAC would shift from moderate to high. The Butte and southern portion of the Upper Columbia-Salmon-Clearwater RACs would improve from low to moderate habitat capability.

Based on this data, habitat capability would to continue to support white-tailed deer population levels generally similar to or slightly higher than current, although population numbers can be influenced by numerous factors other than habitat capability. Where habitat capability increases, hunting opportunities could increase. However, as with elk and mule deer, it would be less likely that the potential increases in white-tailed deer numbers would keep pace with anticipated future demand by hunters. Therefore, because of non-habitat factors, over the 100-year prediction period, hunting opportunities for white-tailed deer would likely be reduced from current levels.

Other Species

The predicted habitat capacity for *bighorn sheep* (Terrestrial Family 5) would increase slightly from current levels with all alternatives. Based on this prediction, habitat would be available to continue to support bighorn sheep population levels at similar or slightly higher than current populations. This could make slightly more animals available for harvest. Harvest of bighorn sheep is highly regulated as demand currently exceed supply. Hunting opportunities for bighorn sheep would likely be maintained at current levels, although population numbers can be influenced by numerous factors other than habitat capability. Implementation of

Alternatives S2 and S3 would have the most improvement, followed closely by Alternative S1. Mountain goats are also in Terrestrial Family 5 and would probably be affected similarly.

The predicted habitat capacity for *pronghorn antelope* (Terrestrial Family 10) would decrease slightly from current levels with all alternatives. Based on this prediction, habitat would be available to continue supporting pronghorn populations that are similar to or slightly reduced from current levels. Harvest of pronghorn is highly regulated as demand currently exceeds supply. Hunting opportunities for pronghorn could be reduced slightly from current opportunities, although population numbers can be influenced by numerous factors other than habitat capability. Implementation of all alternatives would have similar effects.

The predicted habitat capacity for *American marten* (Terrestrial Family 2) would increase substantially from current levels with all alternatives. Based on this prediction, habitat would be available to support higher marten populations than current population levels. Currently there is little increasing demand for marten or furbearers in general, and it would not be anticipated that demand would increase to the same degree as with some other species. Therefore, trapping opportunities for marten would be increased from current levels, and it would be unlikely that demand would exceed supply. Implementation of Alternative S2 would have the most improvement, followed closely by Alternative S3. There would be least improvement with Alternative S1. The fisher is also in Terrestrial Family 2 and would probably be affected similarly.

The predicted habitat capacity for *blue grouse* (Terrestrial Families 2 and 3) would increase substantially from current levels with all alternatives. Based on this prediction, habitat would be available to support higher blue grouse population levels than currently. It is not anticipated that demand would increase to the same degree as with some other species. Therefore, hunting opportunities for blue grouse should be increased from current levels, and it would be unlikely that demand would exceed supply. Implementation of all alternatives would have similar effects on blue grouse.

The predicted habitat capacity for *sage grouse* (Terrestrial Family 11) and *Columbian sharp-tailed grouse* (Terrestrial Family 12) would decrease from current levels with all alternatives. Based on this prediction, habitat would be less available to support population levels of both species. It is not anticipated that demand would increase to the same degree as with some other species. However, hunting opportunities for these grouse species would be decreased from current levels, and it would be likely that demand would exceed supply. Implementation of Alternative S2 followed closely by Alternative S3 would slow declines in habitat to a greater extent than with Alternative S1.

The *western gray squirrel* is included in Terrestrial Family 1. The amount of source habitat would be reduced for this species under all alternatives. This could decrease hunting opportunities, although population numbers can be influenced by numerous factors other than habitat capacity. Implementation of Alternatives S2 and S3 would slow declines to a greater extent than with Alternative S1.

Habitat conditions would improve under all alternatives for harvested species which are dependent on riparian or wetland habitats (such as *ducks* and *geese*). This should have a positive effect on hunting opportunities for these species, although population numbers can be influenced by numerous factors other than habitat capability. Implementation of Alternative S2 would have the most improvement. There would be less improvement with Alternative S3, followed closely by Alternative S1.

Some harvested terrestrial species (such as *moose, black bear, mountain lion, chukar, California quail,* and *turkey*) were not included as species of focus, because there of their current abundance, the lack of risk factors, or current restricted harvest. It is anticipated that hunting opportunities would continue at current levels.

The effects of harvesting *plants* are generally localized, and the degree of these effects can not be evaluated at the broad scale. However, Alternatives S2 and S3 should have positive effects on species adversely affected by harvesting by providing management direction that focuses on development of conservation strategies for species of broad-scale concern, and on maintenance and/or restoration of harvestability of all species, to a higher degree than Alternative S1. This should benefit species which may be adversely affected by harvesting, especially those harvested for commercial purposes.

Aquatic–Riparian–Hydrologic Component

This section presents the effects of the alternatives on aquatic and riparian habitats, water quality, and aquatic species. A summary of key effects and conclusions for all subject areas is presented first. Each subject area then begins with methods of estimating effects, followed by the analysis of effects.

Summary of Key Effects and Conclusions

The largest increase in aquatic habitat capacity would come from Alternative S2, followed by Alternative S1 and then Alternative S3. Alternative S2 would maintain or improve riparian ecological processes, while Alternative S1 would likely maintain them and Alternative S3 would contain more uncertainty. Water quality effects can be thought of as indicators of the upland physical and biological processes. For example, high water quality generally suggests that these processes are on an improving trend, characteristic of historical succession and disturbance regimes.

Aquatic habitat on BLM- and Forest Service-administered lands is vital to native fish populations, but other factors are also important, such as effects from harvest, dams that restrict fish migrations, non-native aquatic species, and human activities and habitat conditions on private lands.

Aquatic and Riparian Habitats

- All three alternatives are projected to improve aquatic habitat conditions on BLM- and Forest Service-administered lands compared to projections of current conditions over the long term. The largest increase in aquatic habitat capacity would occur under Alternative S2 and the smallest increase under Alternative S3.
- Alternative S2 would maintain and improve riparian ecological processes through time, based on the interim RCA delineation criteria. Some uncertainty is associated with the other two alternatives, where one-half site potential tree height is used as an interim RCA delineation criterion.

Water Quality

- In the long term (100 years) all three alternatives are predicted to improve water quality conditions on BLM- and Forest Service-administered lands compared to current conditions.
- Alternative S2 is predicted to have the most positive influence on water quality, while Alternative S3 is predicted to result in the least improvement.

Aquatic Species

- All alternatives are expected to result in improved population status and habitat capacity for the six key salmonids over the long term. Predicted changes in population status reflect less improvement than does habitat capacity because of other biological constraints on a population's response (for example, exotic species and migratory corridor survival) and uncertainty in the analysis. Overall, Alternative S2 is expected to result in the most improvement for these six species. Alternative S3 is expected to result in the least improvement when compared to the other two alternatives.
- Other factors beyond Forest Service or BLM management authority may limit the response of aquatic species to habitat conservation and restoration on federal lands. These factors include condition of non-federal habitat and non-native fish species. It is assumed that habitat conditions on non-federal lands would remain stable or would slightly improve over the long term.
- Although stream-type chinook and steelhead habitat capacity would substantially improve under all alternatives, population status outcomes reflect minor or no improvement. Population status outcomes reflect the assumptions regarding biological constraints which influence survival throughout their life cycle. The greatest uncertainty is associated with migration corridor survival, especially for populations above several

dams in the Snake River and Upper Columbia River. Management of habitat on Forest Service- and BLM-administered lands is expected to play a major but not exclusive role in the future status of the species. Rehabilitation of depressed populations above several dams cannot be accomplished via federal habitat improvement alone but will require improvements in migration corridor survival and efforts to address causes of mortality in other life stages. However, securing and restoring federal freshwater habitat may be critical to the short-term persistence of many anadromous populations. Trends in improving strong status and habitat associated with Alternative S2 were slightly greater than those in Alternatives S1 and S3; thus, Alternative S2 is expected to result in more favorable conditions supporting the persistence of anadromous fish.

Aquatic and Riparian Habitats

Methodology: How Effects on Aquatic and Riparian Habitats were Estimated

The Draft EIS evaluation methods consisted of arraying available alternative information (such as management direction, projected levels of activity, some model results, and knowledge of fish or habitat distribution and status) and asking one or more experts to formulate opinions on the likely future outcomes. A different evaulation method is used in this Supplemental Draft EIS to display future outcomes from the alternatives (Rieman et al. 1999), because:

- For the Draft EISs, it was difficult to account for multiple interacting effects. Assumptions were stated but it was hard to determine how they influenced outcomes or uncertainty in outcomes.
- With the Draft EIS methodology, it was difficult to replicate or update the analysis when management drivers or key assumptions were modified.
- Results were not easily quantified and were not spatially explicit for the Draft EISs. This made it difficult to evaluate relative differences among alternative outcomes.

To address these issues the aquatic Science Advisory Group (SAG) used a model called Bayesian Belief Networks (BBN) as a formal framework for the analysis of the Supplemental Draft EIS alternatives (see sidebar in Terrestrial Species section of this chapter and Rieman et al. [1999] for description of the model). Bayesian Belief Networks provide a quantitative framework that allows the use of quantitative and qualitative information to be combined in an evaluation process. These models also allow incorporation of uncertainty into this process. Using Bayesian Belief Networks, the aquatic SAG linked key processes in aquatic systems and conditions to landscape characteristics that are predicted to change as a result of management activities.

Bayesian Belief Networks were developed to estimate trends in aquatic habitat capacity and future status of key salmonids. Model outputs were estimated probabilities of particular states occurring within a subwatershed at 10- and 100-year time periods for each alternative and current condition. In this context, probabilities measure the relative strength of a particular outcome. Current condition represents a projection of approximately 1996–1998 aquatic a d riparian conditions and management directio

Changes in aquatic habitat capacity were examin d using counts of the most likely state (high, moderat , low; see Glossary) and probabilities for high and l w habitat capacity. The most likely state was estimat d as that with the greatest probability. For example, f the probability of high aquatic habitat capacity w s greater than both moderate or low, then the mo t likely state was classified as hig

Differences among the alternatives and evaluati n time periods were examined by comparing: (1) t e number of subwatersheds where the most likely sta e was high or low; and (2) the mean probability of hi h and low habitat capacity of subwatersheds for feder l lands and all lands. (Federal lands are defined f r this purpose as subwatersheds where federal ownership is 50 percent or higher.) NOTE: Summa y counts of the most likely state should not be considered a prediction of the actual number of subwatersheds with high or low aquatic habitat capacity, b t rather as a summary of trend or differences betwe n the alternative

Effects of the Alternatives on Aquatic and Riparian Habitats

Aquatic Habitat Capacity

Projected changes in aquatic habitat capacity at 10 years were small. Consistent declines in habitat capacity were evident at 10 years only in Alternative S3. These results may suggest that greater risks exist in the short term with Alternative S3.

The remaining effects discussion is focused on changes at 100 years. Based on the number of subwatersheds with a change in aquatic habitat capacity state, all three alternatives are projected to improve aquatic habitat conditions on BLM- or Forest Service-administered lands compared to current conditions (Figure 4-12). However, the magnitude of change varies among alternatives. Compared to current conditions, Alternative S2 would result in 51 percent improvement in aquatic habitat capacity (from low to moderate or high), followed by Alternative S1 at 43 percent and Alternative S3 at 30 percent. Alternative S2 would result in the largest number of subwatersheds moving out of a low aquatic habitat capacity state. Compared to Alternative S1, Alternative S2 would result in 18 percent greater improvement in aquatic habitat capacity, while Alternative S3 would result in 30 percent less improvement to aquatic habitat capacity.

Mean probability for high aquatic habitat capacity displayed similar relative trends as the counts of subwatersheds. Compared to projections of current conditions, Alternative S2 is expected to increase the mean probability by 19 percent, followed by Alternative S1 at 16 percent and Alternative S3 at 15 percent. Map 4-7 displays the projected spatial changes in high habitat capacity probability for the three alternatives compared to current conditions.

In summary, the largest increase in aquatic habitat capacity would occur under Alternative S2 and the smallest increase under Alternative S3. Alternative S2 would result in the largest number of subwatersheds moving out of low aquatic habitat capacity and a higher mean probability for high aquatic habitat capacity. Alternative S1 would show more subwatersheds moving out of low, and a larger mean probability of high than Alternative S3.

The level of aquatic habitat maintenance and restoration provided by a particular alternative had the greatest influence on the projected aquatic habitat capacity outcomes among model input variables. Other model input variables that had major influences on projected outcomes among alternatives were changes in road density and future livestock grazing.

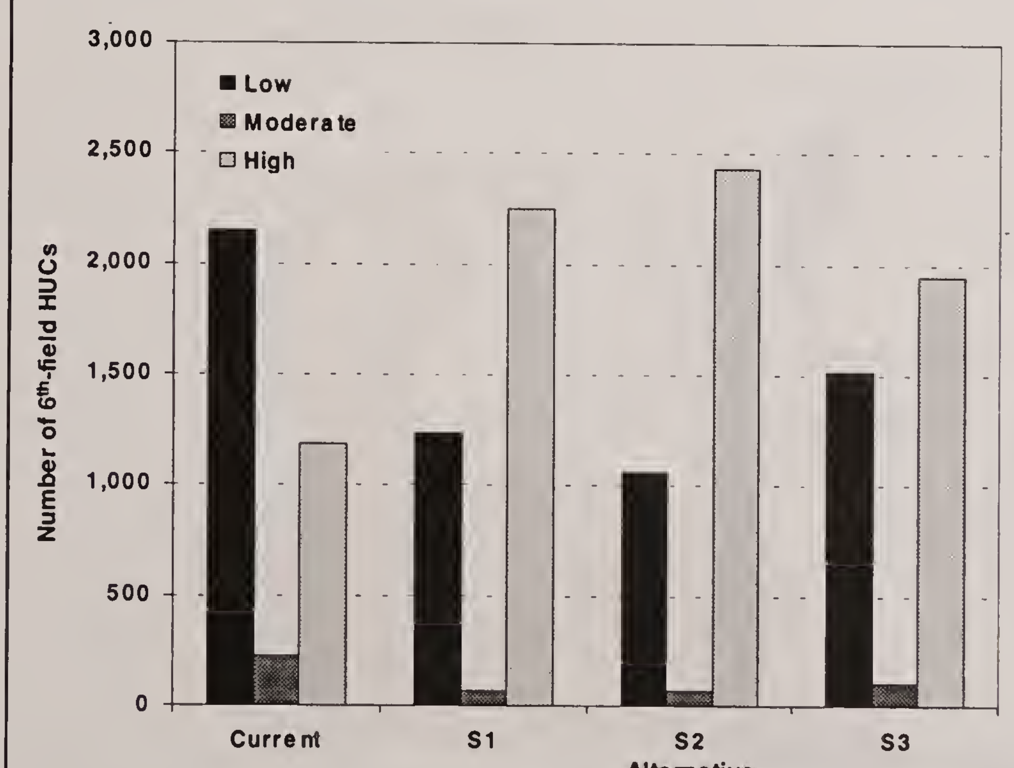


Figure 4-12. Change in Aquatic Habitat Capacity State for BLM- and Forest Service-administered Lands – Long Term.

Riparian Habitats

All alternatives have goals, objectives, and standards pertaining to the maintenance and restoration of riparian areas and wetlands. Riparian management direction associated with Alternatives S2 and S3 is more focused on achieving desired outcomes and is less specific on management activity requirements than Alternative S1. Initial compliance and consistent implementation of management direction may be higher with Alternative S1; however, greater flexibility to tailor management needs to ecological conditions (with potentially better acceptance of and commitment to outcomes) may be associated with Alternatives S2 and S3. Alternative S2 would maintain riparian ecological processes through time based on the interim RCA delineation criteria. Some uncertainty is associated with the other two alternatives, where

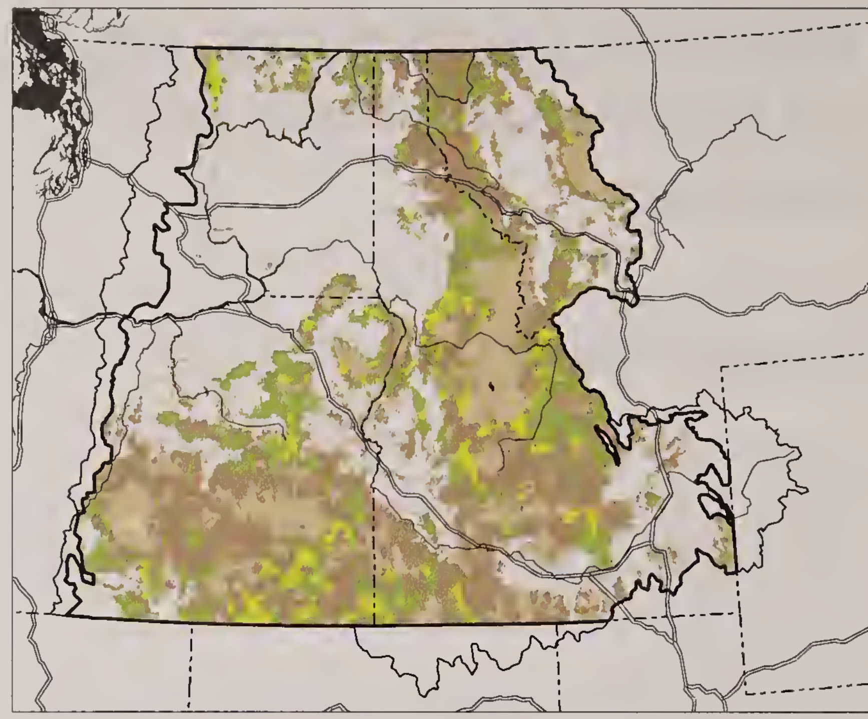
Map 4-7. High Aquatic Habitat Capacity Probability: Change from Current

BLM- and Forest Service-Administered Lands Only

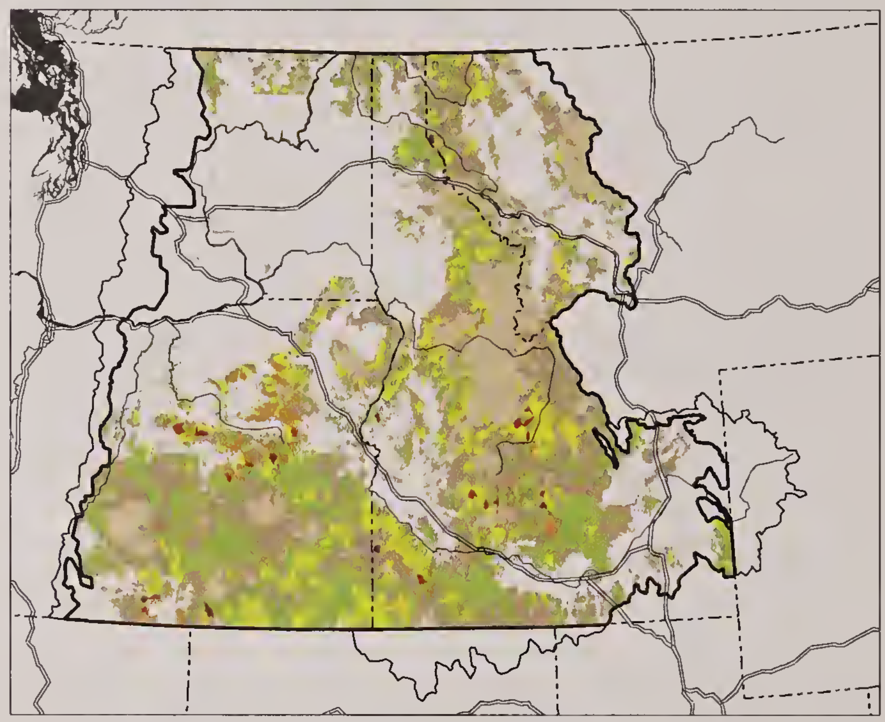
-10 - 0%
1 - 10%
11 - 20%
21 - 30%
31 - 40%
41 - 50%
51 - 60%
61 - 70%
Major Rivers
Major Roads
Supplemental Draft EIS Area Border

INTERIOR COLUMBIA BASIN ECOSYSTEM MANAGEMENT PROJECT

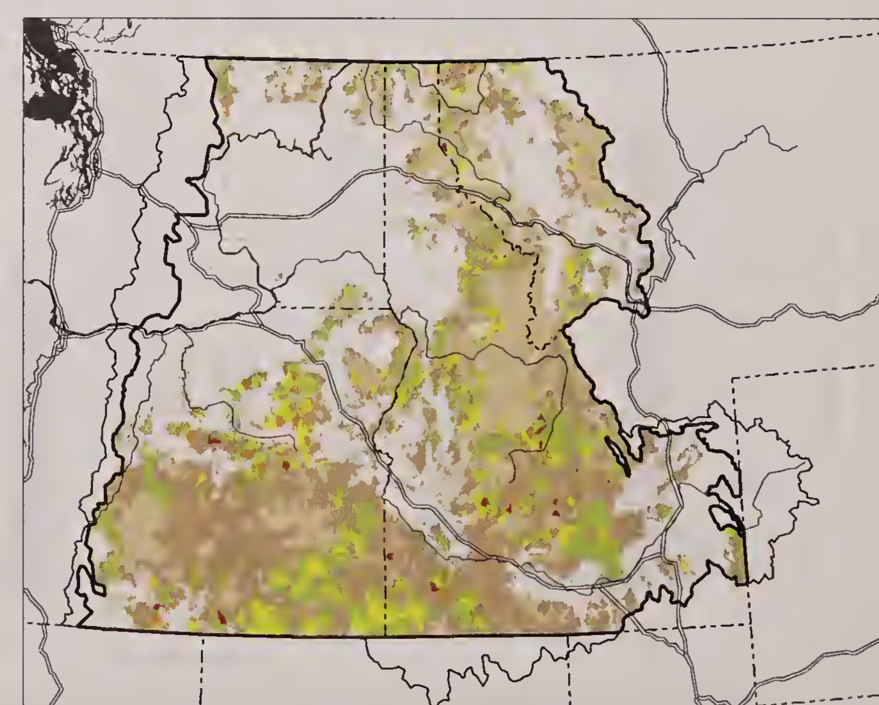
Supplemental Draft EIS Area 2000



Alternative S1



Alternative S2



Alternative S3

one-half site potential tree height is used as an interim RCA delineation criteria (see Chapter 3; RCA Delineation section for applicable areas). RCAs of one site potential tree height provide little margin for uncertainty and may not provide for full riparian ecological function (Sedell et al. 1997; National Research Council 1996). The one-half site potential tree height criterion would apply to a larger area in Alternative S3 and thus would result in the highest uncertainty associated with maintainance of riparian processes.

The extent of the area given riparian consideration and emphasis varies by alternative (Figure 4-13). Using broad-scale information, Alternative S2 would result in the most area within RCAs, followed by Alternatives S1 and S3. At finer scales, the area within RCAs will vary depending on local conditions such as landform, climate, and geology as illustrated by the examples shown in Table 4-28. However, the relative ranking, in terms of area within RCAs, would remain the same as displayed at the broad scale.

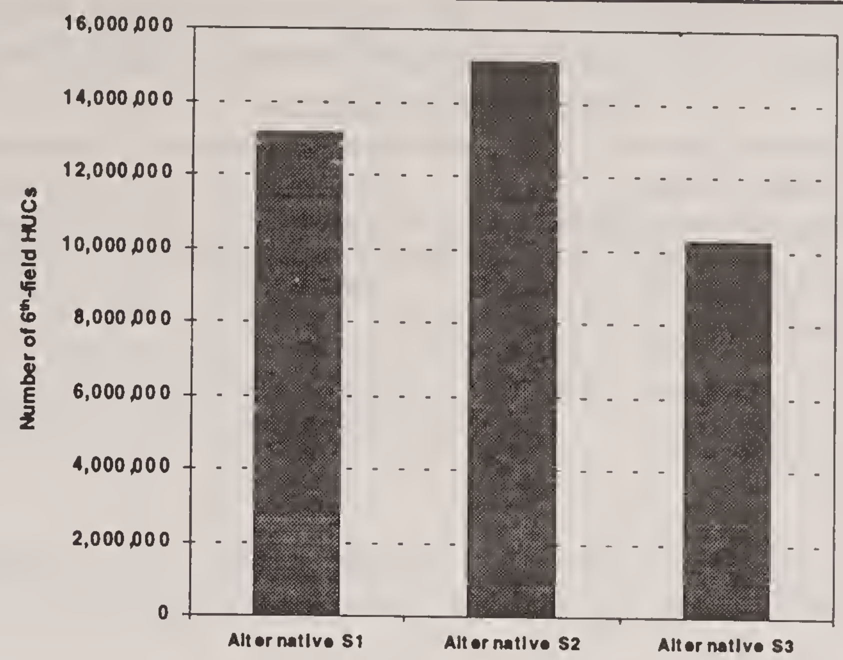


Figure 4-13. Estimated Acres of BLM- and Forest Service-administered Lands Within Riparian Conservation Areas (RCAs).

Ecological functions provided by riparian vegetation are achieved at different distances depending on the function and width of riparian vegetation (Lee et al. 1997; FEMAT 1993). Use of fixed distances from the streambank in delineation of RCAs, without opportunity for adjustments, would not account for variable ecological conditions. Each alternative allows for adjustment to interim RCAs to account for ecological variability. Adjustments to interim RCAs in Alternative S1 can be made after conducting either EAWS or site-specific analysis with the result documented in the appropriate NEPA document. In Alternatives S2 and S3, adjustment to interim RCAs can be made after conducting EAWS or programmatic planning processes followed by site-specific analysis, with the result documented in the appropriate NEPA document. Alternative S1 thus provides flexibility for adjustment; however, PACFISH/INFISH implementation monitoring indicates adjustment to interim RCAs using site-level analysis is difficult because it is less acceptable to some publics and other agencies because of the lack of larger context information on riparian condition and function (Gordon Haugen, USDA Forest Service, personal communication).

Although less flexible, Alternatives S2 and S3 set the expectation that RCAs will be adjusted at the site level following completion of a larger scale analyses. The rate and acceptance of RCA adjustment maybe higher with Alternative S2 because of its greater emphasis on EAWS compared to Alternatives S1 and S3.

Alternatives S2 and S3 would have designated areas to reduce sediment delivery to the RCA; such designated areas would be absent in Alternative S1. In Alternative S2 this consideration applies to all RCAs while in Alternative S3 it applies only to intermittent stream RCAs (Figure 4-14). The width of area is based upon hillslope steepness. New management activities within this sediment-delivery area are to be

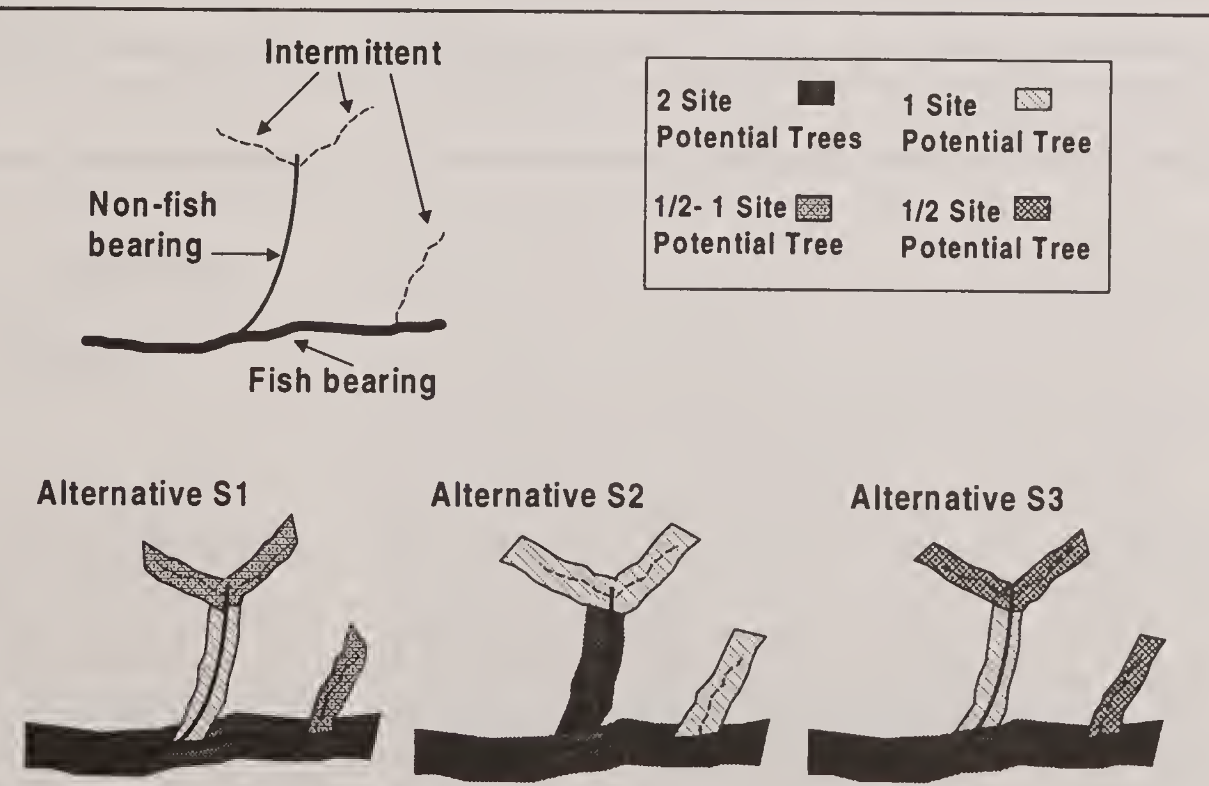


Figure 4-14. Schematic Delineation of Riparian Conservation Areas.

Table 4-28. Examples of Percent Subwatershed Area Within Streamside RCAs,[1] for Each Alternative.

Subwatershed/ Potential Vegetation Type	Information Source	Subwatershed Area (Acres)	Alternative	Percent of Subwatershed within Streamside RCAs
170602050903 Cold Forest	Boise NF	26,150	S1	10
			S2	11
			S3	9
170501221301 Dry Forest	Boise NF	23,926	S1	12
			S2	13
			S3	10
170501200401 Dry Forest	Boise NF	10,884	S1	12
			S2	16
			S3	11
170603071010 Moist Forest	Clearwater NF[2]	23,200	S1	30
			S2	51
			S3	30
170603062520 Moist Forest	Clearwater NF[2]	27,100	S1	26
			S2	43
			S3	26
170603035720 Moist Forest	Clearwater NF[2]	7,600	S1	20
			S2	33
			S3	20
170603030320 Moist Forest	Clearwater NF[2]	5,300	S1	40
			S2	63
			S3	40
1706010411F Dry Forest	Boise Cascade	16,776	S1	20
			S2	24
			S3	15

Abbreviations used in this table:
RCA = Riparian Conservation Area
NF = National Forest

[1] Site-potential tree height was used as the RCA delineation criteria. Values for site-potential tree height are based on information in Appendix G (UCRB) or 3-4 (Eastside) of the Draft EISs.

[2] Alternatives S1 and S3 results for the Clearwater NF information are the same because no intermittent streams occur within these four subwatersheds. If intermittent streams existed, Alternative 2 would still have the greatest area within RCAs followed by Alternative S1 and Alternative S3.

Major Changes from the Draft EISs

Methodology
The Draft EIS alternatives were evaluated by the Science Integration Team (SIT) by arraying available alternative information (such as management direction, projected levels of activity, some model results, and knowledge of fish or habitat distribution and status) and asking one or more experts to formulate opinions on likely future outcomes. The Supplemental Draft EIS alternatives were evaluated by the Science Advisory Group (SAG) using a model called Bayesian Belief Networks (BBN), which allowed for both quantitative and qualitative information to be combined to arrive at the effects analysis. (See Terrestrial Species section for a description of the BBN.)

Native Fish Species
The Draft EISs included analysis of effects on ocean-type chinook salmon; this species was not included in the evaluation of the Supplemental Draft EIS because virtually all spawning and rearing habitat for ocean-type chinook salmon occurs on non-federal land.

The Draft EISs included evaluation of effects on 18 sensitive fish species, including the Wood River bridgelip sucker; the Supplemental Draft EIS effects analysis for aquatics does not explicitly include the Wood River bridgelip sucker, but it does include results for Wood River sculpin habitat, which coincides with habitat for the sucker.

conducted in manner that limits sediment movement into the RCA. This would prevent or reduce riparian and in-stream effects due to management-induced sediment delivery. Additionally, all three alternatives require that unstable or potentially unstable lands be managed to not increase the natural frequency and distribution of landslides. This requirement would prevent or minimize management-related landslides, reducing negative impacts on riparian and aquatic habitats.

Water Quality

Methodology: How Effects on Water Quality were Estimated

The models used for the aquatic analysis [Bayesian Belief Network (BBN)] were not constructed to directly evaluate the effects of alternatives on water quality. However, the aquatic habitat capacity module within the BBN includes components that can serve as proxies for some, but not all, water quality parameters. For example, the sediment 'node' within the aquatic habitat capacity model was used to estimate trends in sediment production and delivery. The sediment node characterizes the likelihood that accelerated sediment will be delivered to a stream; it can provide an indication of effects and trends on water quality. Factors that influenced sediment delivery in the model included changes in road density/road disturbance and estimated soil disturbance from proposed timber harvest and prescribed fire activities.

The model ranked subwatersheds into low, moderate, or high sediment delivery classes for current conditions and the alternatives. The "low" sediment delivery class was assigned to subwatersheds where accelerated sediment yields are less than 20 percent over natural. This value is based on studies that indicate a 20 percent *sustained* increase in depositional sediment yield is needed to detect a significant change in stream channels resulting from disturbance by logging, fire, or roads (J. King, personal communication, letter on file). Because of differing rock types, landforms, and valley bottom-channel type combinations, there are large natural variations in sediment yields. For some stream systems, increases in sediment delivery may need to be higher than 20 percent to detect significant changes in stream channels. Subwatersheds classified as "moderate" were estimated to have sediment delivery ranging from 20 to 100 percent over natural. This delineation is based on the level of increase that will generally result in stream bed morphology changes such as pool filling and excessive sediment deposition in spawning

substrate. "High" was assigned to subwatersheds having greater than 100 percent over natural sediment delivery.

Differences among the alternatives and current conditions were determined by comparing the sediment delivery ratings for subwatersheds for the short term (10 years) and the long term (100 years). The sediment delivery and water quality evaluation applies only to federal lands within the project area, which are defined as subwatersheds where ownership by the federal land management agencies is 50 percent or greater.

Rationale for Qualitative Interpretation of Modeling of Management Alternatives

Qualitative interpretation of potential effects on water quality included evaluation of the alternatives on riparian and aquatic habitats, watershed protection and restoration via the A1/A2 networks, high restoration priority subbasins, and step-down analysis. Favorable outcomes for these management elements return desirable sediment delivery and riparian conditions that provide benefits to water quality.

Direction requiring the Forest Service and BLM to apply the 303(d) protocol was issued while SAG was in the process of completing their effects analysis. Therefore, the protocol was modeled under Alternatives S2 and S3 and not modeled for Alternative S1. This direction requires Forest Service and BLM units within the project area to implement the 303(d) protocol, regardless of which alternative is selected. Any analyses for proposed management activities within a subbasin containing a 303(d) listed water body will incorporate the protocol.

Effects of the Alternatives on Water Quality

Direct effects on water quality are best predicted using modeled results for sediment production and delivery. Indirect effects can be evaluated by interpreting expected outcomes for water quality indicators such as riparian condition and aquatic habitat capacity. Additional considerations in the proposed management direction that can affect water quality conditions and trends include the high restoration priority subbasins and the 303(d) protocol.

Sediment Delivery Effects on Water Quality

There were no discernible differences in effects on sediment delivery, and therefore on water quality, among the alternatives in the short term (10 years) (Rieman et al. 1999).

For the long term (100 years), the *Effects Analysis* indicates implementing Alternative S2 would result in more positive outcomes with respect to water quality than the other alternatives. The relative benefits associated with Alternative S2 include a projected two-fold increase in likelihood for low sediment delivery class compared to Alternatives S1 and S3, and slightly lower probabilities for high and moderate sediment classes than the other two alternatives. The *Effects Analysis* suggests Alternative S3 would have slightly higher likelihood for the high and moderate sediment delivery classes, and lower probability for the low sediment delivery class compared to Alternative S1. To summarize, Alternative S2 is predicted to have a more positive influence on water quality, while Alternative S3 is predicted to result in the least improvement.

Trends in effects on water quality were determined by evaluating the changes in probabilities for low, moderate, or high sediment delivery class caused by each of the three alternatives compared to the current condition of each subwatershed. In the long term (100 years) all three alternatives are predicted to improve water quality conditions on BLM- and Forest Service-administered lands compared to current conditions (see Figure 4-15).

To summarize the long-term trends of the effects on water quality, the probability of improving water quality through reductions in the moderate or high sediment delivery class is highest for Alternative S2, with Alternative S1 having a slightly higher probability than Alternative S3.

Related Water Quality Indicators

Water quality effects are basically response indicators, suggesting that the physical and biological processes within the project area are moving in an improving trend, characteristic of their geomorphic setting and natural disturbance and recovery regimes. The trends in sediment production and delivery, used as an indicator for determining effects on water quality, are similar to those for riparian conditions and aquatic habitat.

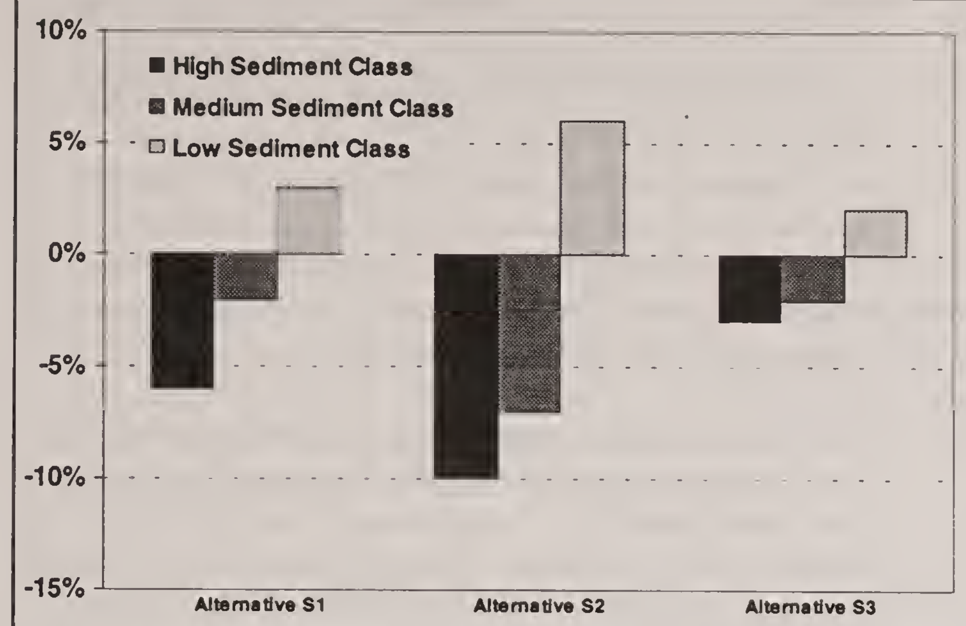


Figure 4-15. Change in Sediment Production and Delivery Class From Current Condition (at 10 years).

Having fully functioning or improving riparian conditions indicates positive effects on water quality. Intact riparian condition includes stable soils, abundant native vegetation, and channel geometry that reflects neither atypical widening nor incision. Functioning riparian condition provides several processes that maintain water quality, including: sediment storage during overbank flow, energy dissipation, nutrient uptake and storage, and channel shading. Water quality parameters that would be beneficially affected by intact riparian habitat include suspended sediment, bedload sediment, water temperature, dissolved and readily available nutrients, and dissolved oxygen. In relating the effects of the alternatives predicted for riparian habitats on sediment delivery, Alternative S2, followed by Alternative S1, would provide higher benefits to water quality. Higher risk of maintaining or protecting riparian function is predicted for Alternative S3 (see Effects on Aquatic and Riparian Habitats, earlier in this section).

In addition to riparian conditions, the likelihood for high aquatic habitat capacity provides another qualitative relationship to water quality and beneficial use support. High aquatic habitat capacity includes sufficient structure from coarse wood and large boulders to provide a mix of channel habitats, sediment particle size distributions on the channel bottom that indicate sufficient transport of fine particles, and appropriate amounts of stable, overhanging streambanks that are characterized by adequate natural vegetation. Desirable outcomes of high aquatic habitat are highest for Alternative S2, followed by Alternatives S1 and S3, respectively. These ratings imply water quality conditions under Alternative S2 would more likely support beneficial uses than Alternatives S1 or S3.

Effects of High Restoration Priority Subbasins on Water Quality

High restoration priorities are identified at the subbasin scale. Similar to the sediment delivery classifications for subwatersheds, road density/road disturbance, ground disturbance, and management direction were the primary factors influencing sediment delivery at the subbasin scale. Subbasins containing subwatersheds with a current rating for high sediment delivery are those having the most road disturbance. The largest decreases in high sediment delivery would occur under Alternatives S2 and S3 in subbasins that are identified as priorities for restoration. Within the high restoration priority subbasins, the management direction focuses on minimizing or mitigating negative impacts by implementing activities in a manner that will produce effects that resemble natural disturbance regimes (that is, "high" sediment delivery is influenced most by the management direction node in the Bayesian Belief Network model).

Likewise, a low rating for sediment delivery is most influenced by high maintenance/restoration themes in the management direction of Alternative S2. The management direction elements likely to influence processes related to sediment and hydrologic regimes and riparian function (such as riparian buffers, A1/A2 watershed designations, and Subbasin Review and EAWS criteria) were considered to increase the effectiveness of restoration activities in Alternative S2 more than Alternative S3. For Alternatives S2 and S3, high maintenance/restoration management direction infers successful mitigation in the implementation of restoration activities. New and ongoing activities proposed in Alternatives S2 and S3 would not likely impair watershed processes and would not retard the recovery of watershed processes or riparian function.

Effects of 303(d) Protocol

It was previously mentioned that the 303(d) protocol was not modeled for Alternative S1. Had the protocol been modeled for that alternative, slightly greater decreases in sediment delivery might be expected than those initially estimated for Alternative S1.

An additional consideration is the intent for the protocol to be applied along with or prior to the completion of Ecosystem Analysis at the Watershed Scale (EAWS). The rate and effectiveness of active restoration combined with the overlap of areas

requiring EAWS could shorten the time for bringing 303(d) waters into compliance. In Alternative S3 the frequency of EAWS is predicted to be higher than in Alternative S1. Therefore, it is likely that Alternative S3 would result in greater decreases in sediment delivery and subsequent improvements in water quality than Alternative S1, more so if increased analyses and activities are proposed in subbasins with 303(d) waters. This would be especially true if activities are planned primarily in the integrated restoration priority subbasins.

Including the protocol under all alternatives would still result in Alternative S2 having the greatest decreases in sediment delivery, with more positive benefits to water quality. Qualitatively, considering only the application of the 303(d) protocol, Alternative S3 may be slightly better than Alternative S1 in addresssing water quality concerns.

Native Fish and Other Aquatic Species

Methodology: How Effects on Aquatic Species were Estimated

Similar to aquatic habitat capacity, the relative change in future population status for six key salmonids was examined using the classifications of the most likely population status (strong, depressed, or absent) summarized as the count or probability of strong or present (strong and depressed). The analysis was limited to subwatersheds containing spawning and rearing habitat for the species. (The aquatic science advisory group did not include ocean-type chinook salmon in this analysis because virtually the entire spawning and rearing habitat for this species occurs on non-federal land.) A subwatershed was classified as strong when the probability for strong was greater than the probability for depressed and their sum exceeded absent.

The differences among alternatives were examined by comparing: (1) the number of subwatersheds where the most likely state was strong or present; and (2) the mean probabilities for each future state for subwatersheds on BLM- and Forest Service-administered lands and all lands. The 10-year summaries are not included in this evaluation because they differed little from current conditions. NOTE: as with habitat capacity, summary counts of the most likely state should not be considered a prediction of the actual number of strong or depressed populations, but as a summary useful for considering the relative trend or differences among the alternatives.

Habitat capacity and population states or probability outcomes are compared against the current condition and Alternative S1. Comparisons to current conditions are termed relative change, which is expressed as a percent change from current conditions. Comparisons to Alternative S1 are termed relative benefit, which is the percentage increase or decrease of the relative change of Alternatives S2 and S3 compared to the relative change of the no-action alternative.

The aquatic science advisory group did not attempt to model alternative effects on sensitive aquatic species status because the specific environmental requirements of these species are largely unknown. However, they did summarize changes in habitat capacity across the distribution of these species. Summary information is presented and is useful for considering which species may experience relatively large or minor changes relative to current conditions.

For further information on analysis methods see Rieman et al. (1999).

Effects of the Alternatives on Fish and Other Aquatic Species

Aquatic Mollusks

Six federally listed threatened or endangered aquatic mollusks are found within the project area. Three of these species occur on BLM-administered lands in Idaho: Banbury Springs lanx (*Lanx* sp.), Bliss Rapids snail (*Taylorconcha serpenticola*), and Utah valvata (*Valvata utahensis*). Effects on aquatic mollusks were not analyzed because of the landscape-scale nature of the data compared to the limited and localized distributions of these species. Future analysis of effects of proposed management on habitat or populations should be conducted on a site-specific basis.

'Viability' and 'Persistence'

The regulations implementing the National Forest Management Act (NFMA) require that:

> *Fish and wildlife habitat shall be managed to maintain viable populations of existing native and desired non-native vertebrate species in the planning area. For planning purposes, a viable population shall be regarded as one which has the estimated numbers and distribution of reproductive individuals to insure its continued existence is well distributed in the planning area. In order to insure that viable populations will be maintained, habitat must be provided to support, at least, a minimum number of reproductive individuals and that habitat must be well distributed so that those individuals can interact with others in the planning area.*

Key points of this requirement are that: (1) the obligation is to provide habitat, but the adequacy of that habitat must be judged on the basis of its capability to support populations; (2) the requirement is to provide for habitat that can support a population that is well-distributed across the planning area, not just a population that can persist within the planning area; (3) the term well-distributed is defined in terms of the ability of individuals of the species to interact with each other. Biological and legal interpretation of the concept of well-distributed has further clarified that it must be judged relative to the life history and historical distribution of the species. Many species were not historically distributed in a continuous fashion across the landscape, and it should not be expected that they would be continuously distributed across the future landscape. Legal interpretation has also clarified that it is not a requirement to absolutely "insure" species viability, but that the level of certainty should reflect both biological reality and needs for multiple-uses (see 1994 Dwyer decision, Northwest Forest Plan). Thus, viability and risk must be expressed as variables, and the trade-offs between them made explicit.

The regulation also makes it clear that viability is a requirement of the federal landscape (that is, the "planning area"). This requirement creates stiff analytical challenges, as species populations operate across entire landscapes with no reference to land ownership. The aquatic species effects analysis presented in the Supplemental Draft EIS provides the information that the decision makers will use to judge whether federal habitat management meets the NMFA requirements. These include analyses of aquatic habitat capacity (a count of subwatersheds in and probability of high habitat capacity in potential spawning and rearing habitat) and population status outcomes (a count of subwatersheds with and probability of strong species status and species presence in potential spawning and rearing habitat). Declining trends in these indicators are likely to be associated with increasing threats to the persistence of existing populations and less potential for rebuilding populations in depressed portions of species' ranges; increasing trends in the indicators should suggest decreasing threats to persistence and more potential for rebuilding populations. All the necessary analysis is presented here that contributes to concluding likelihood of viability, although the final determination of viability will be made in the Record of Decision.

Introduced Fish Species

Effects analyses were not conducted for introduced fish species. The distribution and status of some introduced fish species tend to be influenced by repeated stocking and therefore are not good indicators of changes in habitat condition.

Native Fish Species

Effects analyses and outcomes were directed exclusively at six key salmonids: bull trout, westslope cutthroat trout, Yellowstone cutthroat trout, redband trout, steelhead, and stream-type chinook salmon. Ocean-type chinook salmon were not included in the evaluation because virtually all spawning and rearing habitat for this species occurs on non-federal land. The key salmonids were selected for analysis because of their importance as broad indicators of aquatic integrity and the large amount of existing information for these species.

Overall effects of the alternatives on the six key salmonids were assessed with respect to changes in aquatic habitat capacity and influences of biological constraints (such as threats from exotic aquatic species, current productivity of the population) on population response.

The analysis was limited to the estimated spawning and rearing habitat for the species for the following reasons: (1) spawning and rearing habitats are the critical areas found predominately on federal land and most likely to be sensitive to land management; (2) spawning and rearing habitats are more likely to be in headwater systems sensitive to land management activities; and (3) knowledge and ability to predict effects on other habitats is poor.

The following effects discussion for the six key salmonids is derived from the species-specific narratives, outcomes, and other information provided in the aquatics chapter (Rieman et al. 1999) of the *SAG Effects Analysis* (Quigley 1999). Population response was not considered over the short term (10 years) because predicted changes were very small. For most species, 10 years is an insufficient time frame to expect substantive differences in effects among alternatives. Reported outcomes reflect estimates about how population status would change over the long term (50 to 100 years) if the alternatives were implemented and the intent of the alternatives followed in coming decades.

The SAG evaluation for narrow endemic and sensitive species focused on 17 of the 39 identified species in the aquatics chapter (Lee et al. 1997) of the *Assessment of Ecosystem Components* (Quigley and Arbelbide 1997). The basis for species selection is described in the aquatics chapter (Sedell et al. 1997) of the *Evaluation of Alternatives* for the Draft EISs (Quigley, Lee, and Arbelbide 1997). The Draft EIS evaluation included 18 sensitive species, including the Wood River bridgelip sucker. The Supplemental Draft EIS *Effects Analysis* for aquatics (Rieman et al. 1999) does not explicitly include the Wood River bridgelip sucker, but it does include results for Wood River sculpin habitat, which coincides with habitat for the sucker.

Habitat capacity outcomes were directed mainly at habitat needs for the six widely distributed salmonids. However, a brief summary of trends in habitat capacity associated with distribution of the sensitive species was provided by SAG. The SAG did not attempt to model the specific effects of changes in habitat capacity on the sensitive species because the specific environmental requirements of these species are largely unknown. While the trends presented are useful for considering the implications of the alternatives on these species, the SAG did not interpret these trends because the implied changes or interactions with other species that respond to changes in habitat may be positive for some species and negative for others. However, the summary is useful for determining which species may experience relatively large or minor changes as compared to current conditions.

Bull Trout

A positive long-term trend in bull trout population strong status is projected for all alternatives compared to current conditions (Table 4-29). The number of subwatersheds estimated as strong would increase approximately 14 percent under Alternatives S1 and S2, and 12 percent under Alternative S3. Mean probability of strong status also shows a similar trend. In comparsion to Alternative S1, Alternative S2 would have the same outcome for the number of subwatersheds projected as strong and the mean probability of strong status. The relative benefit of Alternative S3 would be slightly less when compared to Alternative S1.

Projected bull trout presence also shows positive trends for all alternatives over the long term compared to current conditions (Table 4-29). Subwatersheds classified as present for bull trout would increase three percent under Alternatives S1 and S2, and two percent for Alternative S3. Mean probabilities display a similar trend. In comparison to Alternative S1, Alternative S2 would have the same population outcomes. Relatively, Alternative S3 would result in less benefit to bull trout presence when compared to Alternative S1.

Similar to changes in population status, high aquatic habitat capacity within estimated bull trout spawning and rearing habitat is projected to increase in the long term compared to current conditions under all alternatives (Table 4-29). However, the changes are more substantial. Subwatersheds in high aquatic habitat capacity are projected to increase 60 percent, 57 percent, and 32 percent for Alternatives S1, S2, and S3, respectively. Mean probability for aquatic habitat capacity in high status also would increase over current conditions for all alternatives, with Alternatives S1 and S2 having similar outcomes. The benefit of Alternative S2 to bull trout habitat would be similar to Alternative S1, while Alternative S3 would be substantially less than Alternative S1.

In summary, all alternatives are expected to show positive changes in future population status and aquatic habitat capacity relative to current conditions on Forest Service- and BLM-administered lands. Outcomes for Alternative S1 and S2 would be similar, because of the compensating effect of the extensive coverage of priority watersheds in Alternative S1 compared to the hierarchical analyses, restoration priorities, and the A1/A2 network in Alternative S2. Alternative S3 would have consistently lower out-

Table 4-29. Counts and Mean Probabilities for Strong Status, Presence, and High Habitat Capability for the Six Fish Species Used to Evaluate Effects of the Alternative over the Long Term.

Species	Current[1]	Alternative S1	S2	S3
Bull Trout				
Strong				
Count[2]	310	352	352	347
Relative Change[3] (%)		13.5	13.5	11.9
Relative Benefit[4] (%)			0.0	**-11.9**[5]
Mean Probability[6]	0.183	0.198	0.198	0.195
Relative Change (%)		8.2	8.2	6.7
Relative Benefit (%)			0.0	**-18.2**
Presence				
Count	1069	1099	1100	1089
Relative Change (%)		2.8	2.9	1.9
Relative Benefit (%)			3.3	**-33.3**
Mean Probability	0.451	0.468	0.467	0.463
Relative Change (%)		3.8	3.7	2.8
Relative Benefit (%)			**-2.4**	**-26.0**
High Habitat Capacity				
Count	1040	1663	1629	1371
Relative Change (%)		59.9	56.6	31.8
Relative Benefit (%)			**-5.5**	**-46.9**
Mean Probability	0.380	0.439	0.440	0.425
Relative Change (%)		15.4	15.9	11.9
Relative Benefit (%)			3.2	**-22.8**
Westslope Cutthroat Trout				
Strong				
Count	459	503	500	490
Relative Change (%)		9.6	8.9	6.8
Relative Benefit (%)			**-6.8**	**-29.5**
Mean Probability	0.289	0.308	0.309	0.304
Relative Change (%)		6.6	6.9	5.1
Relative Benefit (%)			4.8	**-22.0**
Presence				
Count	1289	1293	1292	1291
Relative Change (%)		0.3	0.2	0.2
Relative Benefit (%)			**-25.0**	**-50.0**
Mean Probability	0.627	0.645	0.645	0.639
Relative Change (%)		3.0	3.0	2.0
Relative Benefit (%)			0.0	**-32.0**
High Habitat Capacity				
Count	853	1378	1366	1091
Relative Change (%)		61.5	60.1	27.9
Relative Benefit (%)			**-2.3**	**-54.7**
Mean Probability	0.383	0.440	0.441	0.424
Relative Change (%)		15.0	15.3	10.9
Relative Benefit (%)			2.0	**-27.4**
Yellowstone Cutthroat Trout				
Strong				
Count	11	14	15	15
Relative Change (%)		27.3	36.4	36.4
Relative Benefit (%)			33.3	33.3
Mean Probability	0.215	0.224	0.235	0.231
Relative Change (%)		4.2	9.7	7.7
Relative Benefit (%)			132.2	85.0

Table 4-29. Counts and Mean Probabilities for Strong Status, Presence, and High Habitat Capability for the Six Fish Species Used to Evaluate Effects of the Alternative over the Long Term. (continued)

Species	Current[1]	Alternative S1	S2	S3
Presence				
Count	50	50	50	50
Relative Change (%)		0.0	0.0	0.0
Relative Benefit (%)			0.0	0.0
Mean Probability	0.561	0.566	0.570	0.568
Relative Change (%)		0.9	1.8	1.3
Relative Benefit (%)			91.5	44.3
High Habitat Capacity				
Count	19	36	41	35
Relative Change (%)		89.5	115.8	84.2
Relative Benefit (%)			29.4	**-5.9**
Mean Probability	0.293	0.327	0.358	0.343
Relative Change (%)		11.5	22.1	17.2
Relative Benefit (%)			92.2	49.5
Redband Trout				
Strong				
Count	497	649	674	627
Relative Change (%)		30.6	35.6	26.2
Relative Benefit (%)			16.4	**-14.5**
Mean Probability	0.266	0.283	0.287	0.282
Relative Change (%)		6.1	7.6	6.0
Relative Benefit (%)			25	**-0.7**
Presence				
Count	1335	1346	1347	1340
Relative Change (%)		0.8	0.9	0.4
Relative Benefit (%)			9.1	**-54.5**
Mean Probability	0.580	0.588	0.590	0.587
Relative Change (%)		1.4	1.7	1.3
Relative Benefit (%)			24.9	**-4.1**
High Habitat Capacity				
Count	654	1224	1340	1113
Relative Change (%)		87.2	104.9	70.2
Relative Benefit (%)			20.4	**-19.5**
Mean Probability	0.333	0.389	0.402	0.387
Relative Change (%)		16.8	20.8	16.3
Relative Benefit (%)			23.8	**-3.2**
Steelhead				
Strong				
Count	6	14	14	14
Relative Change (%)		133.3	133.3	133.3
Relative Benefit (%)			1.0	1.0
Mean Probability	0.104	0.111	0.112	0.111
Relative Change (%)		6.4	7.9	6.5
Relative Benefit (%)			23.1	1.4
Presence				
Count	101	101	101	101
Relative Change (%)		1.0	1.0	1.0
Relative Benefit (%)			0	0
Mean Probability	0.325	0.331	0.332	0.331
Relative Change (%)		2.0	2.4	2.0
Relative Benefit (%)			20	0
High Habitat Capacity				
Count	500	735	723	669
Relative Change (%)		47	44.6	33.8
Relative Benefit (%)			**-5.1**	**-28.1**

Table 4-29. Counts and Mean Probabilities for Strong Status, Presence, and High Habitat Capability for the Six Fish Species Used to Evaluate Effects of the Alternative over the Long Term. (continued)

Species	Current[1]	Alternative S1	S2	S3
Mean Probability	0.396	0.458	0.465	0.453
Relative Change (%)		15.5	17.3	14.4
Relative Benefit (%)			11.6	**-7.1**
Stream Type Chinook Salmon				
Strong				
Count	2	4	5	5
Relative Change (%)		100.0	150.0	150.0
Relative Benefit (%)			50.0	50.0
Mean Probability	0.053	0.057	0.058	0.057
Relative Change (%)		7.3	8.8	7.4
Relative Benefit (%)			21.8	2.3
Presence				
Count	50	50	50	50
Relative Change (%)		0	0	0
Relative Benefit (%)			0	0
Mean Probability	0.202	0.207	0.208	0.207
Relative Change (%)		2.7	3.1	2.6
Relative Benefit (%)			13.9	**-4.7**
High Habitat Capacity				
Count	494	703	691	641
Relative Change (%)		42.3	39.9	29.8
Relative Benefit (%)			**-5.7**	**-29.7**
Mean Probability	0.406	0.467	0.473	0.462
Relative Change (%)		14.8	16.4	13.7
Relative Benefit (%)			10.8	**-7.5**

[1] Current conditions represent projection of conditions equivalent to those present in 1994.
[2] Counts represent the number of subwatersheds projected to be in a particular state within potential spawning and rearing habitat for the species.
[3] Relative change was calculated as the percent increase over base.
[4] Relative benefit is the percentage increase (+) or decrease (-) of the relative change of Alternatives S2 and S3 compared to the relative change of the no action alternative.
[5] Bold values represent a decline from either base or S1 conditions.
[6] Mean probability is the mean for all subwatersheds.

Source: Rieman et al. 1999.

comes because of the increased uncertainty associated with implementation of EAWS and lower amount of protection provided by RCAs. Nevertheless, bull trout are projected to persist under all alternatives over the long term.

All alternatives would secure and strengthen the core distribution of the species and would prevent further declines in populations through prevention of further degradation and improvement in spawning and rearing habitat over the long term. Positive trends are associated with the depressed portions of the distribution, but they are not strong enough to suggest substantial rebuilding in currently depressed areas. Some loss in populations may continue to occur, however, even without further habitat loss, because of biological constaints and/or natural disturbance events. Bull trout population response to increases in habitat capacity would be constrained by factors affecting the biological potential of populations, including such factors as threats from exotic species, the highly depressed state of the current distribution of bull trout, and low support from populations for refounding adjacent bull trout populations.

Westslope Cutthroat Trout

Estimates for all alternatives indicate a positive trend compared to current conditions for strong westslope cutthroat trout status over the long term (Table 4-29). Subwatersheds classified as strong would increase approximately ten percent under Alternative S1, nine percent under Alternative S2, and seven percent under Alternative S3. Mean probability of strong status also displays a similar trend. In comparing change in subwatersheds classified as strong, Alternative S2 would have slightly less benefit than Alternative S1. However, Alternative S2 would have a slightly higher probability of strong status than Alternative S1. Alternative S3 would have substantially less benefit than Alternative S1.

Projected westslope cutthroat presence is expected to slightly increase under all alternatives over the long term compared to current conditions (Table 4-29). Counts for present are projected to increase less than one percent in all alternatives. Mean probabilities for presence show larger increases over current conditions than do counts, with Alternative S1 and S2 having the same outcome and a larger increase than Alternative S3. Alternative S2 would have population presence outcomes similar to Alternative S1. Relatively, Alternative S3 would result in less improvement than Alternative S1.

High aquatic habitat capacity within estimated westslope cutthroat trout spawning and rearing habitat is projected to increase in the long term as compared to current conditions under all alternatives (Table 4-29). Changes in habitat capacity are more substantial than population outcomes. Subwatersheds in high aquatic habitat capacity are projected to increase 62 percent for Alternative S1, 60 percent for Alternative S2, and 28 percent for Alternative S3. Mean probabilities for aquatic habitat capacity in high status also would increase for all alternatives. Compared to current conditions, Alternatives S1 and S2 would would have the highest increase in mean probability, followed by Alternative S3. The relative benefit of Alternative S2 to habitat condition would be similar to Alternative S1. Alternative S3 would result in substantially less benefit to westslope cutthroat trout habitat when compared to Alternative S1.

In summary, all alternatives would produce positive trends in population status and habitat condition for westslope cutthroad trout when compared to current conditions over the long term on Forest Service- and BLM-administered lands. Therefore, it is expected westslope cutthroat trout would persist over the long term under all alternatives. Alternatives S1 and S2 would have similar population and habitat outcomes. Outcomes for Alternative S3 would be consistently less than the other two alternatives. Reasons for these outcomes are similar to those presented for bull trout.

All alternatives are likely to conserve and strengthen the core of the westslope cutthroat trout distribution. Alternative S2 would result in stronger trends in improvement in the fringe distribution than other alternatives. Positive trends are associated with the depressed portions of the distribution, but they are not strong enough to suggest substantial rebuilding in currently depressed areas. Habitat outcomes would be substantially higher than population status outcomes for all alternatives. Westslope cutthroat trout population responses would be constrained by other factors affecting the biological potential of populations, including such factors as threats from exotic species, the highly depressed state of the current distribution, and low support from populations for refounding adjacent westslope cutthroat populations.

Yellowstone Cutthroat Trout

A positive long-term trend in Yellowstone cutthroat trout population strong status is projected for all alternatives compared to current conditions(Table 4-29). Subwatersheds classified as strong would increase approximately 27 percent under Alternative S1 and 36 percent for Alternatives S2 and S3. The mean probability for strong status is projected to increase the most under Alternative S2, followed by Alternative S3 and Alternative S1. Both Alternatives S2 and S3 would result in more benefit to strong Yellowstone cutthroat status than Alternative S1, with Alternative S2 having the most benefit.

Although subwatershed counts for projected Yellowstone cutthroat trout presence would not change for any alternative when compared to current conditions (Table 4-29), mean probability of presence would increase slightly for all alternatives over current conditions (1–2 percent) in the long term. Alternative S2 would result in the most improvement, followed by Alternative S3 and Alternative S1.

High aquatic habitat capacity within estimated spawning and rearing habitat is expected to increase under all alternatives in the long term when compared to current conditions (Table 4-29). Subwatersheds in high aquatic habitat capacity are projected to increase 90 percent under Alternative S1, 116 percent under Alternative S2, and 84 percent under Alternative S3. Mean probability for high aquatic habitat capacity showed the greatest increase under Alterna-

tive S2 followed by Alternative S3 and Alternative S1. Alternative S2 would result in more benefit to Yellowstone cutthroat trout habitat than Alternative S1. Alternative S3 would result in less benefit than Alternative S1 when comparing subwatersheds classified as high aquatic habitat capacity, but more benefit when comparing mean probabilities.

In summary, all alternatives would produce positive trends in population status and habitat condition when compared to current conditions over the long term on Forest Service- and BLM-administered lands. Outcomes for Alternative S2 would consistently display more improvement in population status and habitat than the other alternatives. Outcomes for Alternative S1 would be consistently less than the other two alternatives. Reasons for these outcomes are the conservation/restoration emphasis provided by the A1/A2 subwatersheds and high restoration priorities in Alternatives S2 and S3, compared to little to no conservation/restoration emphasis in Alternative S1 except for RCA management direction. Given that all alternatives would improve over current conditions, it is expected that Yellowstone cutthroat trout would persist under all alternatives over the long term.

All alternatives are likely to conserve and strengthen the core of the Yellowstone cutthroat trout distribution within the project area. Most of the species range is not included in the project area. Parts of the excluded distribution are remote and within parks or reserves providing habitat protection that is lacking in the lower elevations of the distribution. There are no fringe populations within the project area. Habitat outcomes would be substantially higher than population status outcomes for all alternatives. Status of many populations is uncertain because of the potential for hybridization with non-native trout.

Redband Trout

Estimates for all alternatives indicate a positive trend compared to current conditions for strong redband trout status over the long term (Table 4-29). Subwatersheds classified as strong would increase approximately 31 percent under Alternative S1, 36 percent for Alternative S2, and 26 percent for Alternative S3. The mean probability for strong status is also projected to increase under all alternatives, with Alternative S2 showing the highest increase and Alternatives S1 and S3 having similar outcomes. Alternative S2 would result in more benefit to strong redband trout status than Alternative S1. Alternative S3 would result in similar or slightly less benefit than Alternative S1.

Projected redband presence is expected to slightly increase under all alternatives over the long term compared to current conditions (Table 4-29). Counts for present were projected to increase less than one percent in all alternatives. Mean probabilities for presence showed larger increases over current conditions than do counts, with Alternative S2 having the most improvement over current conditions. Alternative S2 would result in more benefit than Alternative S1. Alternative S3 would result in similar or slightly less benefit than Alternative S1.

Similar to changes in population status, high aquatic habitat capacity within estimated redband trout spawning and rearing habitat is projected to increase in the long term compared to current conditions under all alternatives (Table 4-29). However, the changes would be more substantial. Subwatersheds in high aquatic habitat capacity are projected to increase 87 percent under Alternative S1, 105 percent under Alternative S2, and 70 percent under Alternative S3. Mean probability for aquatic habitat capacity in high status also would increase over current conditions for all alternatives, with Alternative S2 having the highest increase followed by Alternative S1 and Alternative S3. Alternative S2 would result in more benefit to redband trout habitat than Alternative S1. Alternative S3 would result in slightly less benefit than Alternative S1.

In summary, all alternatives would produce positive trends in population status and habitat condition when compared to current conditions over the long term on Forest Service- and BLM-administered lands. Therefore, it is expected that redband trout would persist under all alternatives. Outcomes for Alternative S2 consistently display more improvement in population status and habitat than the other alternatives. Outcomes for Alternative S1 would be slightly greater than Alternative S3. Alternative S2 would result in the strongest improvement because of a greater emphasis on conservation and restoration provided by the A1/A2 subwatersheds, RCA management direction, and restoration priorities compared to Alternative S1. Alternative S3 generally would result in the least improvement because of the uncertainty associated with implementation of EAWS and lower amount of protection provided by RCAs.

All alternatives are likely to conserve and strengthen the core of the redband trout distribution within the analysis area. Positive trends are also expected in depressed portions of the species distribution. These trends suggest that some rebuilding may be expected in the southern portions of the species distribution. Alternative S2 would produce the strongest trend

"Strong" Populations

For this discussion, 'strong' populations or 'stronghold' subwatersheds for key salmonids have the following characteristics:

1. All major life-history forms that historically occurred within the subwatershed are present;
2. Numbers are stable or increasing and the local population is likely to be at half or more of its historical size or density;
3. The population or metapopulation within the subwatershed, or within a larger region of which the subwatershed is a part, probably contains at least 5,000 individuals or 500 adults.

compared to the other alternatives. Each alternative is expected to strengthen and improve the fringe distribution, expecially Alternative S2.

Steelhead

Over the long term, model results indicate a slight positive trend from current conditions for strong status under all alternatives (Table 4-29). Since the number of strong subwatersheds is so low, the percentage changes in counts among the alternatives and current conditions are not meaningful. Counts for strong would show an increase of eight subwatersheds for all alternatives. Mean probability of strong status would increase eight percent under Alternative S2 and approximately six percent under Alternatives S1 and S3. Relatively, Alternative S2 would result in more benefit to strong status than Alternative S1. Alternatives S3 and S1 are expected to result in similar benefits to strong steelhead status.

The projected counts of steelhead presence would not vary among the alternatives and current conditions (Table 4-29). Changes in mean probability of presence would increase approximately two percent under all alternatives.

Much different than population status outcomes, high habitat capacity is projected to substantially increase for steelhead under all alternatives compared to current conditions over the long term (Table 4-29). Subwatersheds in high aquatic habitat capacity are projected to increase 47 percent under Alternative S1, 45 percent under Alternative S2, and 34 percent under Alternative S3. Mean probability of high habitat capacity also would increase over current conditions for all alternatives, with Alternative S2 having the highest increase followed by Alternative S1 and Alternative S3. Although Alternative S2 would have fewer subwatersheds classified as high capacity, mean probabilities indicate a stronger trend and thus more benefit than Alternative S1. Outcomes for Alternative S3 would be less than Alternative S1 and are expected to result in less benefit to steelhead habitat.

Although steelhead habitat capacity would improve substantially under all alternatives, population status outcomes reflect minor or no improvement because of the many physical and biological constraints and uncertainty associated with the steelhead life cycle. The greatest uncertainty is associated with migration corridor survival, especially for populations above several dams in the Snake River and upper Columbia River. Management of habitat on Forest Service- and BLM- administered lands is expected to play a major but not exclusive role in the future status of the species. Rehabilitation of depressed populations above several dams cannot be accomplished via federal habitat improvement alone but will require improvements in migration corridor survival (Marmorek et al. 1998) and efforts to address causes of mortality in other life stages (Lee et al. 1997). However, securing and restoring federal freshwater habitat may be critical to the short-term persistence of many steelhead populations (Lee et al. 1997). Trends in improving strong status and habitat associated with Alternative S2 are larger than those in Alternatives S1 and S3 and thus are expected to result in more favorable conditions supporting the persistence of steelhead.

Stream-Type Chinook Salmon

Projected trends for stream-type chinook salmon over the long term indicate positive trends from current conditions for strong status under all alternatives (Table 4-29). Because the number of strong subwatersheds is so low, a percent change comparison among the alternatives and current conditions is not meaningful. Counts for strong show an increase of two

subwatersheds for Alternative S1, and three subwatersheds for Alternatives S2 and S3. Mean probability of strong status would increase nine percent under Alternative S2 and approximately seven percent under Alternatives S1 and S3. Relatively, Alternative S2 would result in more benefit to strong status than Alternative S1. Alternatives S3 and S1 are expected to result in similar benefits to strong stream-type chinook status.

The projected counts of stream-type chinook presence do not vary among the alternatives and current conditions (Table 4-29). Changes in mean probability of presence would increase approximately two to three percent under all alternatives, with Alternative S2 projected to result in the most improvement.

Similar to steelhead effects, high habitat capacity is projected to substantially increase under all alternatives compared to current conditions over the long term (Table 4-29). Subwatersheds in high aquatic habitat capacity are projected to increase 42 percent, 40 percent, and 30 percent for Alternatives S1, S2, and S3, respectively. Mean probability high habitat capacity also increases over current conditions for all alternatives, with Alternative S2 having the highest increase followed by Alternative S1 and Alternative S3. Although Alternative S2 would have fewer subwatersheds classified as high capacity, mean probabilities indicate a stronger trend and thus more benefit than Alternative S1. Outcomes for Alternative S3 would be less than Alternative S1 and are expected to result in less benefit to stream-type chinook.

Similar to steelhead, habitat capacity for stream-type chinook would improve substantially under all alternatives, yet population status outcomes reflect minor or no improvement. Like steelhead, population status outcomes reflect the many biological constraints which influence survival throughout the stream-type chinook life cycle. A major uncertainty is associated with migration corridor survival, especially for populations above several dams in the Snake River and upper Columbia River. These populations are more likely to be absent in the future than those populations in downstream areas (such as the middle Columbia). Similar to steelhead, management of habitat on Forest Service- and BLM-administered lands is expected to play a major but not exclusive role in the future status of stream-type chinook. Rehabilitation of depressed populations above several dams cannot be accomplished via federal habitat improvement alone but will require improvements in migration corridor survival (Marmorek et al. 1998) and efforts to address causes of mortality in other life stages (Lee et al. 1997). However, securing and restoring federal freshwater habitat may be critical to the short-term persistence of many stream-type chinook populations (Lee et al. 1997). Trends in improving strong status and habitat associated with Alternative S2 would be larger than those in Alternatives S1 and S3, and thus are expected to result in more favorable conditions supporting the persistence of stream-type chinook.

Narrow Endemic and Sensitive Native Fish

As mentioned previously, the SAG did not attempt to model the effects of changes in habitat capacity on these sensitive species because the specific environmental requirements of these species are largely unknown. The trends presented are useful for considering the implications of the alternatives on these species. The SAG did not interpret these trends because the implied changes or interactions with other species that respond to changes in habitat may be positive for some species and negative for others. However, the summary is useful for determining which species may experience relatively large or minor changes as compared to current conditions.

Long-term trends in habitat capacity would be positive under all alternatives in areas associated with the 17 species (Table 4-30). The greatest increases in habitat capacity occurred in Alternative S2 (11 species) followed by Alternative S1 (6 species). Alternative S3 never resulted in the most improvement for a species among the alternatives.

Only widely distributed threatened and endangered aquatic species were selected by SAG for in-depth effects analysis.

Threatened and Endangered Aquatic Species

Only widely distributed threatened and endangered aquatic species were selected by SAG for in-depth effects analysis. Those federally listed species occurring on more than one national forest or BLM district and affected by land management activities and having sufficient information on life history and habitat requirements were selected for analysis. These species include bull trout, steelhead (Upper Columbia, Middle Columbia, and Snake River), and chinook salmon (Upper Columbia spring, Snake River spring/summer). Similar information as the preceding sections is presented below for each of these species, but the information is summarized here by specific geographic areas that correspond to the range of listed species or stocks. This summarized informa-

Table 4-30. Relative Ranking of Mean Probabilities for High Habitat Capacity in Areas Associated with the Distribution of 17 Sensitive Native Fishes over the Long Term.

Species	Alternative S1	S2	S3
Goose Lake Sucker	3	1	2
Klamath Largescale Sucker	2	1	3
Lahontan Cutthroat Trout	1	2	3
Leatherside Chub	3	1	2
Lost River Sucker[1]	1	2	2
Malheur Sculpin	3	1	2
Margined Sculpin	2	1	3
Oregon Lakes Tui Chub	3	1	2
Pacific Lamprey	2	1	3
Pit-Klamath Brook Lamprey	2	1	3
Pygmy Whitefish	1	2	3
Shorthead Sculpin	2	1	3
Shortnose Sucker	1	2	3
Slender Sculpin	1	2	3
Torrent Sculpin	2	1	3
Warner Sucker	1	2	3
Wood River Sculpin	2	1	3

A ranking of "1" indicates the alternative with the highest probability for high habitat capacity.

[1] Alternative S2 and S3 would have the same outcome.

Source: Rieman et al. 1999.

tion is based on the evaluation performed by SAG. The remaining 10 listed species would be best addressed by individual administrative units through existing programmatic and site-specific planning and analyses processes.

Under the Endangered Species Act, federal activities that may have an effect on threatened, endangered, or proposed species are subject to consultation with the U.S. Fish and Wildlife Service or National Marine Fisheries Service. Requirements for consultation would remain in effect under any selected alternative.

Bull Trout

Predicted bull trout population status and habitat capacity in the different geographic areas were similar to those summarized previously for bull trout project area-wide. The trends were generally positive for all alternatives when compared to current conditions (Table 4-31). The largest increases in population outcomes were associated with geographic areas that currently support populations in relatively good condition, such as the Snake River and Upper Columbia River geographic areas. SAG concluded that trends in the Middle Columbia geographic area are not meaningful because most of the potential spawning and rearing habitat is excluded from the project area. Overall, Alternatives S1 and S2 generally would have similar outcomes, while Alternative S3 projections tend to show less improvement than Alternatives S1 and S2. Reasons for the outcomes are similar to those described previously for bull trout.

Steelhead

In all geographic areas, with the exception of the Middle Columbia, there were no changes in the summary counts for strong or present classes and no or slight improvement in probabilities for both classes under all alternatives when compared to current conditions (Table 4-31). Summary counts for strong status indicate an increase of 11 subwatersheds for the Middle Columbia for all alternatives. Probabilities for the strong and present class in the Middle Columbia were projected to slightly increase under all alternatives. The projected population status improvement in the Middle Columbia area is a reflection of predicted improvements in habitat capacity and the lower number of dams (3) steelhead pass en route to spawning and rearing habitat in this area as compared to the other two areas (5 or more dams). The future status of steelhead in the Middle Columbia is more secure and less uncertain than the populations in the two areas upstream.

Habitat capacity estimates indicated a larger improvement than population status projections for all areas under all alternatives as compared to current conditions (Table 4-31). Reasons for this trend are similar to those described previously for steelhead basin-wide. Alternative S2 is predicted to result in greater improvement than Alternative S1 in areas with large amounts of potential spawning and rearing habitat. Alternative S3 would result in less improvement than Alternative S1 except for the Middle Columbia ESU. Reasons for the outcomes are similar to those described previously for steelhead.

Stream-Type Chinook

Model estimates indicate that under all alternatives there would be no change in strong or present summary counts and no or slight improvement in probabilities for both classes as compared to current in all areas except the Middle Columbia (Table 4-31). As compared to current conditions, summary counts for strong status increased by three subwatersheds in Alternative S1 and four subwatersheds in Alternatives S2 and S3 in the Middle Columbia. Summary counts for present did not change from current under all alternatives in the Middle Columbia. Probabilities for the strong and present class in the Middle Columbia were projected to slightly increase under all alternatives. The projected population status improvement in the Middle Columbia area is a reflection of predicted improvements in habitat capacity and the lower number of dams (3) stream-type chinook pass en route to spawning and rearing habitat in this area as compared to the other two areas (5 or more dams). The future status of stream-type chinook in the Middle Columbia is more secure and less uncertain than the populations in the two areas upstream.

Habitat capacity estimates indicated a larger improvement than population status projections for all areas under all alternatives as compared to current conditions (Table 4-31). Reasons for this trend are similar to those described previously for stream-type chinook basin-wide. Alternative S2 is predicted to result in greater improvement than Alternative S1 in areas with large amounts of potential spawning and rearing habitat. Alternative S3 would result in less improvement than Alternative S1 except for the Middle Columbia ESU. Reasons for the outcomes are similar to those described previously for stream-type chinook.

Cumulative Effects on Aquatic Species

Non-federal Habitat

Management of federal habitat for the six species analyzed in depth is expected to play a major although not exclusive role in their future status. Approximately 22 percent of the expected present distribution of bull trout, 28 percent of westslope cutthroat trout, 78 percent of Yellowstone cutthroat trout, 47 percent of redband trout, 43 percent of steelhead, and 27 percent of stream-type chinook salmon occur on *non*-federal lands within the project area.

No alternative specifically addresses the role of non-federal lands with the respect to aquatic ecosystems. Most states within the project area have developed or are in the process of developing conservation plans (such as the Oregon Plan, the Washington Statewide Strategy To Recover Salmon, the Montana Bull Trout and Westslope and Yellowstone Cutthroat Trout Conservation Plans, and the Idaho Bull Trout Plan) and revising land use regulations to address at-risk aquatic species. In addition, many tribal governments within the project area have developed aquatic conservation and restoration strategies (such as *Wy-Kan-Ush-Mi Wa-Kish-Wit* [Columbia River Intertribal Fish Commission 1995]). Because of these efforts, the SAG assumed that aquatic habitat on non-federal lands would remain stable or slightly improve over the long term. However, the rate and extent of improvement are expected to be much lower than that projected for the alternatives for federal lands. Generally, habitat quality tends to be lower on non-federal lands compared to federal lands within the project area (Lee et al. 1997). Some of these conditions (such as high stream temperatures, dewatering, migration barriers) found on non-federal lands may limit the potential effectiveness of habitat conserva-

Table 4-31. Counts and Mean Probabilities for Strong Status, Presence, and High Habitat Capacity for Specific Geographic Areas Within the Distribution of Federally Listed Bull Trout, Steelhead, and Chinook Salmon. Results Represent Effects over the Long Term.

Species	Current[1]	S1	Alternative S2	S3
Bull Trout				
Snake River Geographic Area				
Strong				
Count[2]	222	250	252	247
Relative Change (%)[3]		12.6	13.5	11.3
Relative Benefit (%)[4]			7.1	**-10.7**[5]
Mean Probability[6]	0.216	0.233	0.234	0.231
Relative Change (%)		8.1	8.5	7.3
Relative Benefit (%)			4.9	**-9.6**
Presence				
Count	662	684	683	678
Relative Change (%)		3.3	3.2	2.4
Relative Benefit (%)			**-4.5**	**-27.3**
Mean Probability	0.509	0.527	0.528	0.525
Relative Change (%)		3.7	3.8	3.1
Relative Benefit (%)			2.4	**-15.0**
High Habitat Capacity				
Count	657	943	898	839
Relative Change (%)		43.5	36.7	27.7
Relative Benefit (%)			**-15.6**	**-63.8**
Mean Probability	0.403	0.465	0.467	0.456
Relative Change (%)		15.4	15.9	13.2
Relative Benefit (%)			3.2	**-14.3**
Lower Columbia River Geographic Area				
Strong				
Count	2	2	2	2
Relative Change (%)		0.0	0.0	0.0
Relative Benefit (%)			0.0	0.0
Mean Probability	0.096	0.104	0.105	0.103
Relative Change (%)		8.2	9.3	7.4
Relative Benefit (%)			13.3	**-9.9**
Presence				
Count	53	55	56	55
Relative Change (%)		3.8	5.7	3.8
Relative Benefit (%)			1.5	0.0
Mean Probability	0.311	0.322	0.324	0.321
Relative Change (%)		3.5	4.1	3.4
Relative Benefit (%)			16.2	**-5.3**
High Habitat Capacity				
Count	24	45	48	45
Relative Change (%)		87.5	100.0	87.5
Relative Benefit (%)			14.3	0.0
Mean Probability	0.349	0.408	0.428	0.414
Relative Change (%)		16.9	22.6	18.6
Middle Columbia River Geographic Area				
Strong				
Count	1	1	1	1
Relative Change (%)		0.0	0.0	0.0
Relative Benefit (%)			0.0	0.0
Mean Probability	0.078	0.083	0.083	0.082
Relative Change (%)		6.4	6.4	5.1
Relative Benefit (%)			0.0	**-20.4**

Table 4-31. Counts and Mean Probabilities for Strong Status, Presence, and High Habitat Capacity for Specific Geographic Areas Within the Distribution of Federally Listed Bull Trout, Steelhead, and Chinook Salmon. Results Represent Effects over the Long Term. (continued)

Species	Current[1]	S1	S2	S3
			Alternative	
Presence				
Count	8	8	8	8
Relative Change (%)		0.0	0.0	0.0
Relative Benefit (%)			0.0	0.0
Mean Probability	0.247	0.254	0.253	0.252
Relative Change (%)		2.8	2.4	2.0
Relative Benefit (%)			**-14.3**	**-28.6**
High Habitat Capacity				
Count	0	10	7	4
Relative Change (%)		NA	NA	NA
Relative Benefit (%)			**-30.0**	**-60.0**
Mean Probability	0.278	0.361	0.341	0.325
Relative Change (%)		29.8	22.6	16.9
Relative Benefit (%)			**-24.2**	**-43.3**
Upper Columbia River Geographic Area				
Strong				
Count	77	89	87	87
Relative Change (%)		15.6	13.0	13.0
Relative Benefit (%)			**-16.7**	**-16.7**
Mean Probability	0.153	0.164	0.163	0.160
Relative Change (%)		7.3	6.5	4.5
Relative Benefit (%)			**-10.7**	**-38.4**
Presence				
Count	467	486	486	479
Relative Change (%)		4.1	4.1	2.6
Relative Benefit (%)			0	**-36.8**
Mean Probability	0.432	0.446	0.444	0.440
Relative Change (%)		3.3	2.8	1.7
Relative Benefit (%)			**-15.0**	**-48.0**
High Habitat Capacity				
Count	291	518	494	355
Relative Change (%)		78.0	69.8	22.0
Relative Benefit (%)			**-10.6**	**-71.8**
Mean Probability	0.372	0.428	0.423	0.401
Relative Change (%)		15.1	13.7	7.8
Relative Benefit (%)			**-9.3**	**-48.3**
Steelhead				
Snake River				
Strong				
Count	0	0	0	0
Relative Change (%)		NA	NA	NA
Relative Benefit (%)			NA	NA
Mean Probability	0.075	0.079	0.079	0.079
Relative Change (%)		5.3	5.3	5.3
Relative Benefit (%)			0	0
Presence				
Count	101	101	101	101
Relative Change (%)		1.0	1.0	1.0
Relative Benefit (%)			0	0
Mean Probability	0.325	0.331	0.332	0.331
Relative Change (%)		2.0	2.4	2.0
Relative Benefit (%)			20	0

Table 4-31. Counts and Mean Probabilities for Strong Status, Presence, and High Habitat Capacity for Specific Geographic Areas Within the Distribution of Federally Listed Bull Trout, Steelhead, and Chinook Salmon. Results Represent Effects over the Long Term. (continued)

Species	Current[1]	Alternative S1	S2	S3
High Habitat Capacity				
Count	460	627	597	561
Relative Change (%)		36.3	29.8	22.0
Relative Benefit (%)			**-17.9**	**-39.4**
Mean Probability	0.413	0.474	0.477	0.467
Relative Change (%)		14.8	15.5	13.1
Relative Benefit (%)			4.7	**-11.5**
Middle Columbia River				
Strong				
Count	8	19	19	19
Relative Change (%)		137.5	137.5	137.5
Relative Benefit (%)			0.0	0.0
Mean Probability	0.261	0.272	0.275	0.273
Relative Change (%)		4.3	5.5	4.7
Relative Benefit (%)			27.1	8.4
Presence				
Count	397	397	397	397
Relative Change (%)		0	0	0
Relative Benefit (%)			0	0
Mean Probability	0.648	0.655	0.657	0.655
Relative Change (%)		1.1	1.4	1.1
Relative Benefit (%)			26.6	0
High Habitat Capacity				
Count	26	79	98	85
Relative Change (%)		203.8	276.9	226.9
Relative Benefit (%)			35.8	11.3
Mean Probability	0.308	0.371	0.403	0.384
Relative Change (%)		20.4	30.8	24.6
Relative Benefit (%)			51.0	20.6
Upper Columbia River				
Strong				
Count	0	0	0	0
Relative Change (%)		NA	NA	NA
Relative Benefit (%)			NA	NA
Mean Probability	0.085	0.089	0.089	0.089
Relative Change (%)		4.7	4.7	4.7
Relative Benefit (%)			0	0
Presence				
Count	6	6	6	6
Relative Change (%)		0	0	0
Relative Benefit (%)			0	0
Mean Probability	0.291	0.295	0.295	0.294
Relative Change (%)		1.3	1.3	1.0
Relative Benefit (%)			0	**-23.1**
High Habitat Capacity				
Count	1	8	6	4
Relative Change (%)		700.0	500.0	300.0
Relative Benefit (%)			**-28.6**	**-57.2**
Mean Probability	0.316	0.393	0.373	0.360
Relative Change (%)		24.3	18.0	13.9
Relative Benefit (%)			**-26.0**	**-42.8**

Table 4-31. Counts and Mean Probabilities for Strong Status, Presence, and High Habitat Capacity for Specific Geographic Areas Within the Distribution of Federally Listed Bull Trout, Steelhead, and Chinook Salmon. Results Represent Effects over the Long Term. (continued)

Species	Current[1]	Alternative S1	Alternative S2	Alternative S3
Stream Type Chinook Salmon				
Snake River				
Strong				
Count	0	0	0	0
Relative Change (%)		NA	NA	NA
Relative Benefit (%)			NA	NA
Mean Probability	0.085	0.089	0.089	0.089
Relative Change (%)		4.7	4.7	4.7
Relative Benefit (%)			0	0
Presence				
Count	6	6	6	6
Relative Change (%)		0	0	0
Relative Benefit (%)			0	0
Mean Probability	0.291	0.295	0.295	0.294
Relative Change (%)		1.3	1.3	1.0
Relative Benefit (%)			0	**-23.1**
High Habitat Capacity				
Count	463	625	603	563
Relative Change (%)		35.0	30.0	21.6
Relative Benefit (%)			**-14.3**	**-38.3**
Mean Probability	0.417	0.477	0.481	0.470
Relative Change (%)		14.4	15.3	12.7
Relative Benefit (%)			6.3	**-11.8**
Middle Columbia River				
Strong				
Count	3	6	7	7
Relative Change (%)		100.0	133.3	133.3
Relative Benefit (%)			33.3	33.3
Mean Probability	0.156	0.165	0.168	0.166
Relative Change (%)		5.8	7.7	6.4
Relative Benefit (%)			32.8	10.3
Presence				
Count	134	134	134	134
Relative Change (%)		0	0	0
Relative Benefit (%)			0	0
Mean Probability	0.486	0.492	0.493	0.492
Relative Change (%)		1.2	1.5	1.2
Relative Benefit (%)			25	0
High Habitat Capacity				
Count	19	56	67	58
Relative Change (%)		194.7	252.6	205.3
Relative Benefit (%)			29.7	5.4
Mean Probability	0.317	0.381	0.412	0.394
Relative Change (%)		20.2	30.0	24.3
Relative Benefit (%)			48.5	20.3
Upper Columbia River (spring chinook)				
Strong				
Count	0	0	0	0
Relative Change (%)		NA	NA	NA
Relative Benefit (%)			NA	NA
Mean Probability	0.035	0.036	0.036	0.036
Relative Change (%)		2.9	2.9	2.9
Relative Benefit (%)			0	0

Table 4-31. Counts and Mean Probabilities for Strong Status, Presence, and High Habitat Capacity for Specific Geographic Areas Within the Distribution of Federally Listed Bull Trout, Steelhead, and Chinook Salmon. Results Represent Effects over the Long Term. (continued)

Species	Current[1]	S1	Alternative S2	S3
Presence				
Count	0	0	0	0
Relative Change (%)		NA	NA	NA
Relative Benefit (%)		NA	NA	NA
Mean Probability	0.160	0.163	0.163	0.162
Relative Change (%)		1.9	1.9	1.8
Relative Benefit (%)			0	**-5.3**
High Habitat Capacity				
Count	3	6	5	5
Relative Change (%)		100.0	66.7	66.7
Relative Benefit (%)			**-33.3**	**-33.3**
Mean Probability	0.401	0.459	0.448	0.440
Relative Change (%)		14.5	11.7	9.7
Relative Benefit (%)			**-19.3**	**-33.1**

[1] Current conditions represent projection of conditions equivalent to those present in 1994.
[2] Counts represent the number of subwatersheds projected to be in a particular state within potential spawning and rearing habitat for the species.
[3] Relative change was calculated as the percent increase over base.
[4] Relative benefit is the percentage increase (+) or decrease (-) of the relative change of Alternatives S2 and S3 compared to the relative change of the no action alternative.
[5] Bolded values represent a decline from either base or S1 conditions.
[6] Mean probability is the mean for all subwatersheds.

Source: Rieman et al. 1999.

tion and restoration projected for the alternatives on federal lands.

Non-native Fish Species

The influence of exotic species is another factor over which the BLM and the Forest Service have little management authority but which could potentially limit the effectiveness of habitat improvements under the alternatives. Numerous exotic aquatic species exist within the project area. Generally these species hybridize or compete with native species, reducing genetic purity and displacing them from available habitat. States and tribes have management authority over these populations. The widespread distribution of some exotic species within native fish habitat, and the high value fishery some of these populations support, are problematic. States and tribes have targeted eradication of some local populations of exotic fish species under their conservation plans. A key component to increase the effectiveness of habitat restoration and limit the spread of undesirable exotic aquatic species on BLM- and Forest Service-administered land is collaboration, which is an emphasis of the action alternatives. Early interaction and sharing of information among the responsible agencies would ensure that habitat restoration treatments on federal land: (1) are properly planned, and (2) maintain or reduce the effect of undesirable exotic species. Similarly, all alternatives as well as existing MOUs emphasize that BLM and Forest Service field units provide information regarding state or tribal decisions on fish stocking.

Factors Affecting Anadromous Fish

The most complex and contentious cumulative effects issue relates to restoration of anadromous fish stocks within the project area. The complexity of the anadromous fish life cycle exposes them to many factors influencing their abundance. Human activities have

altered anadromous fish environments leading to widespread declines. These activities are commonly referred to as the 'All Hs'—hydropower, hatcheries, harvest, and habitat. Debate has centered on these four categories relative to their contribution to the overall decline in anadromous fish stocks. Regarding the relative influences of habitat and hydropower on the Snake and Columbia rivers, declines in fish stocks are least attributable to freshwater habitat in the less disturbed areas in central Idaho and the northern Cascades; in these areas, hydropower has the greatest influences on anadromous fish because of the numerous dams below spawning and rearing habitat, which affects migrant survival (Lee and Rieman 1996). Conversely, habitat influences are greater and hydropower effects are less in the middle Columbia area, where there are fewer dams.

Habitat quality is vital to the persistence of anadromous fish stocks. All alternatives would substantially increase the likelihood of high quality habitat, with Alternative S2 having the highest probability. However, steelhead and stream-type chinook population outcomes would only slightly improve, mainly because of uncertainty associated with survival of anadromous fish through the migratory corridor. Influences of hatcheries and harvest on future population status were not modeled by SAG.

The SAG analyzed anadromous fish population outcomes relative to habitat improvements achieved by the alternatives, both with and without an added scenario of improved migrant survival equivalent to a reduction in mortality caused by the lower four Snake River dams. In this scenario, the relative ranking of alternatives did not change (Alternative S2 greater than Alternative S1 greater than Alternative S3) but the magnitude of change in strong populations and, particularly, population presence increased on federal lands (Table 4-32). This indicates a 7- to 10-fold increase in population presence, possibly leading to some rebuilding of anadromous fish stocks on federal lands under all three alternatives if migrant survival were addressed as part of a comprehensive recovery effort. If these conditions are not improved, it is probable that many remaining stocks of anadromous

Table 4-32. Comparison of Counts[1] and Mean Probabilities[2] for Strong Status and Presence for Steelhead and Stream-type Chinook on Federal Lands over the Long Term under Conditions Projected for the Alternatives With and Without Improved Migratory Corridor Survival in the Lower Snake River.

Species	Projections *Without* Improved Migratory Survival in the Lower Snake River Alternative S1	S2	S3	Projections *With* Improved Migratory Survival in the Lower Snake River Alternative S1	S2	S3
Steelhead						
Strong						
Count	14	14	14	33	33	33
Mean Probability	0.111	0.112	0.111	0.283	0.285	0.281
Presence						
Count	101	101	101	758	759	758
Mean Probability	0.331	0.332	0.331	0.652	0.653	0.651
Stream-Type Chinook Salmon						
Strong						
Count	4	5	5	4	5	5
Mean Probability	0.057	0.058	0.057	0.165	0.167	0.165
Presence						
Count	50	50	50	524	524	522
Mean Probability	0.207	0.208	0.207	0.496	0.497	0.495

[1] Counts represent the number of subwatersheds projected to be in a particular state within potential spawning and rearing habitat for the species.
[2] Mean probability is the mean for all subwatersheds.

Source: Rieman et al. 1999.

fish will continue to decline over the long term even with improved federal habitat conditions. In Alternatives S2 and S3, aquatic abitat restoration priorities targeted for anadromous fish upstream of several dams may be reconsidered by decision makers in the future if other mortality sources are not decreased, in order to maximize the effectiveness of habitat restoration investments.

Since publication of the Draft EISs, additional efforts have been made to evaluate mortality contributions related to the 'All Hs,' particularly for Snake River anadromous fish. Most of these studies have focused on the lower Snake River hydrosystem. The Plan for Analyzing and Testing Hypotheses (PATH; Marmorek et al. 1998) evaluated several management options related to hydrosystem operation to enhance recovery of anadromous fish stocks within the Snake River basin. In addition, they conducted sensitivity analyses on the effects of changes in habitat and harvest in relation to the hydrosystem alternatives. Results indicate that hydrosystem options containing scenerios of natural drawdown of the four lower Snake River dams would produce higher biological benefits to anadromous fish than other options. PATH's habitat sensitivity analysis indicated that habitat improvements would result in minor benefits to Snake River spring/summer chinook when comparing hydrosystem options of current condition, current condition plus maximum transport, and natural drawdown of the lower four Snake River dams. Harvest analysis results were dependent on the amount of reduced harvest, harvest schedule, and run size.

Using PATH results and additional information, the National Marine Fisheries Service (NMFS) produced a draft appendix ("A Fish Appendix" [USDC/NMFS 1999]) to the Army Corps of Engineers' Lower Snake River Juvenile Salmonid Migration Feasibility Study. This draft appendix evaluates management alternatives for the four lower Snake River dams in the context of providing for threatened and endangered anadromous fish. NMFS concluded in the draft report that breaching the lower four Snake River dams is more likely than any other hydrosystem management alternative to meet survival and recovery critieria for listed anadromous fish and is the most risk-averse strategy. However, they stated that there are sets of assumptions under which breaching yields little or no improvement over transportation, especially if delayed mortality of transported fish is low.

A draft EIS is being prepared by the Corps of Engineers evaluating several lower Snake River hydrosystem management options. The draft EIS is expected to be complete in December 1999.

Three additional efforts are being developed to address anadromous fish recovery in the Northwest:

- The *Multispecies Framework* directed by the Northwest Power Planning Council is an effort to provide context for decisions concerning multiple species recovery in the Columbia River Basin. The Framework identifies seven broad alternatives for future river management addressing a range of environmental and economic issues. A draft Framework report is expected in late 1999.
- A *paper on the 'All Hs'* (hydropower, hatcheries, harvest, and habitat; see Chapter 2) is being developed by nine federal agencies responsible for anadromous fish management. This is a conceptual document that explores alternative actions to recovery of ESA-listed species, organized around the four factors which affect the life cycle of anadromous fish. It consolidates information from the Framework report. The intent is to develop a conceptual recovery plan that could guide future federal actions. The paper examines several basic options for future management in each of the 'All Hs'. Using these options, a set of integrated alternatives is developed, mixing and matching the various options. These integrated alternatives are intended to illustrate the type of integrated strategies that will be required for successful recovery. They are not presented, however, as the exclusive set of packages that are possible. The goal is to stimulate discussion of what the region can do to recover salmon, steelhead, and other aquatic species. A draft document is expected to be completed in late 1999 or early 2000.
- The *Cumulative Risk Initiative (CRI)* is being developed by NMFS. The CRI is an analytical framework that integrates all risk factors associated with the 'All Hs' across anadromous fish populations and multiple species. A main goal of CRI is to provide decision support for recovery options. The intial round of CRI results should be completed near the end of 1999 or the beginning of 2000. Some preliminary analyses have been conducted for Snake River anadromous fish (NMFS, November 17, 1999, Draft; CRI Assess-

ment of Management Actions Aimed at Snake River Salmonids). From the perspective of extinction risks alone for Snake River fall chinook and steelhead, it appears that harvest reductions would be adequate to sufficiently increase annual population growth rates. It also appears that modest survival improvements due to dam breaching could accomplish the same goals. In addition, dam breaching would also increase the availability of habitat (and thus carrying capacity) for fall chinook, whereas harvest reductions have no such possibility. The situation for Snake River spring/summer chinook is more complicated. Preliminary results indicate that dam breaching alone would not recover Snake River spring/ summer chinook salmon unless very optimistic scenarios were assumed about survival below Bonneville Dam. For aggressive habitat management and other management actions alone to be sufficient for recovery, magnitudes of habitat improvements that are not known to be achievable would have to be assumed, as well as reductions in predation effects for which little data exist. When viewed separately, neither breaching nor habitat/harvest action would have effects on population that are likely to recover Snake River spring/summer chinook salmon. Only in combination would these actions produce an increase in population growth that is close to what is needed for recovery.

As concluded by most of the above efforts, there is no simple answer but only tradeoffs between potential risks and benefits for anadromous fish recovery within the interior Columbia Basin. Learning more and gathering additional information on uncertainities prior to decisions on a comprehensive plan would entail delays, potentially increasing risk of short-term extinction of some anadromous fish populations. All alternatives, especially Alternative S2, would provide protection and restoration of key habitats supporting anadromous fish on federal lands and would contribute to increasing the short-term persistence of anadromous fish. However, rebuilding and long-term persistence will depend on reducing mortality from other factors.

Social–Economic–Tribal Component

This section presents the effects of the alternatives on social-economic considerations and on federal trust responsibility and tribal rights and interests. A summary of key effects and conclusions for both subject areas is presented first. Each subject area then begins with methods of estimating effects, followed by the effects of the alternatives.

Summary of Key Effects and Conclusions

The effects analysis on biophysical resources differs from the socio-economic effects analysis in that most of the biophysical analysis focuses on the long term (100 years) while the socio-economic analysis is more concerned with the short term (10 years). It is clear that the first priority of Alternatives S2 and S3 is restoration of ecosystems and watersheds. However, along with ecological benefits, restoration activities also make an important human contribution through generating employment and economic activities. Overall, Alternative S2 would be best for tribal rights and interests, with Alternative S3 next and Alternative S1 last.

In the first decade, within the project area, livestock grazing on BLM- and Forest Service-administered lands and the number of related jobs would decline most under Alternative S2, followed by Alternative S3. Conversely, first-decade increases in timber volume, forest and rangeland recreation activities, and related jobs are expected to be felt slightly higher under Alternative S2 than Alternative S3. Alternative S1 is expected to hold livestock grazing, timber volumes, restoration, and jobs related to federal land outputs, at near current levels. No broad-scale changes are predicted for levels of recreation and related jobs. In general, economic and social effects at the broad scale would be small. However, this may not be true for geographically isolated communities whose economies are specialized in sectors that depend on outputs from federal lands. In these places, adverse economic and social effects would likely be more pronounced if the levels of outputs and activities from BLM- and Forest Service-administered lands decline.

Social–Economic Considerations

- Timber harvest levels in the first decade are projected to increase at both the basin level and by all RAC/PACs as the consequence of implementation of either Alternative S2 or Alternative S3, compared to Alternative S1. Estimated increases would be just over 21 percent for Alternative S2 and just under 21 percent for Alternative S3. Harvest level increases would come primarily from commercial thinning and other harvest activity designed to promote ecosystem and forest stand restoration (stewardship harvest). While harvest levels would increase in Alternatives S2 and S3, the size and quality of logs produced would decrease because of the stand restoration objectives guiding the thinning and harvest activities. Thus, there is uncertainty about the actual commercial marketability of the volume of wood that is projected for harvest.
- Model projections indicate domestic livestock use of forage, as measured by Animal Unit Months (AUMs), could decline, both basin-wide and by all RAC/PACs (with one minor exception), in the first decade under either Alternative S2 or Alternative S3, compared to Alternative S1. The estimated decreases would be 10 percent for Alternative S2 and 11 percent for Alternative S3. Reductions in AUMs could result indirectly from objectives and standards to be implemented for watershed and rangeland protection and restoration, as well as directly from the continued historical trend of contraction of the livestock industry in the basin from other social, cultural and economic factors.
- Forest/woodland restoration activity (precommercial thinning and planting), measured in acres treated, would increase substantially in the first decade, by 40 percent for Alternative S2 and 36 percent for Alternative S3, compared to Alternative S1. There would be a modest increase in rangeland restoration and maintenance: nine percent for Alternative S2 and four percent for Alternative S3. With the focus on reducing forest and range susceptibility to uncharacteristic wildfire, and the threats to the urban/rural/

wildland interface, there would be large increases in acres treated by prescribed fire and fuels management in the first decade compared to Alternative S1: seven-fold for Alternative S2 and five-fold for Alternative S3.

- Given the broad scale and refined focus of this analysis, there are no projections for changes in recreation use among the alternatives. Therefore, there are no expected changes in recreation-related employment among alternatives.
- Impacts on total basin-wide employment would be negligible—an increase of less than three-tenths of one percent of jobs in the first decade. However, local impacts, both positive and negative, could be much more significant, particularly for rural and tribal communities that are isolated and economically specialized in economic sectors dependent on goods and services from Forest Service- and BLM-administered lands.
- Average annual direct employment associated with Forest Service- and BLM-administered lands would increase by about 3,900 jobs for Alternative S2 and by a little over 3,100 jobs for Alternative S3, compared to Alternative S1. About 35 to 40 percent of the increase would be associated with stewardship timber harvest, and 60 to 65 percent associated with prescribed fire/fuels management. An increase of about 100 jobs per year in forest and rangeland restoration jobs would be matched by a decrease in grazing-related jobs.
- Specific effects of the alternatives on specific local communities or other areas smaller than the RAC/PACs (county, subbasin, community) cannot be measured directly because of the broad-scale nature of this analysis. However, it is likely that isolated and economically specialized communities would be more affected by changes in output and activity levels than communities that are not isolated or economically specialized. And it is likely that, where projected changes within a RAC/PAC are larger, those communities in counties with higher socio-economic resiliency would likely tend to manage change more readily than similar communities in counties where socio-economic resiliency is low.
- Under the action alternatives, restoration activity in the first decade would be focused on high restoration priority subbasins (which include a component of community economic need). Within those subbasins, activities would be first concentrated as near as possible to those isolated and economically specialized communities that are in greatest need of economic stimulus. Alternative S2 would have more acres of restoration and prescribed fire/fuels management work scheduled per year than would Alternative S3. In addition, the work in Alternative S2 would initially be concentrated in 40 high restoration priority subbasins, compared to 51 high restoration priority subbasins in Alternative S3. Therefore, it is expected that the direct community effects in high restoration priority subbasins would be less under Alternative S3 than under Alternative S2 because fewer acres would be treated across a larger area.
- Each of the three alternatives has a certain degree of uncertainty and unpredictability associated with it. The non-traditional broad-scale outcome-based objectives and standards in Alternatives S2 and S3—designed to achieve restoration and maintenance of sustainable ecosystems—have not been operationally tested at this scale before. Therefore, there is uncertainty about the levels of goods and services (timber harvest and grazing) that are projected, as well as the effectiveness of the proposed restoration activities in achieving the desired results. On the other hand, Alternative S1, with its continuation of varying management direction across the basin, and no systematic requirements for hierarchical ecosystem analysis (Subbasin Review or EAWS), also faces uncertainty in implementation. There would continue to be project-by-project and area-by-area consultation and mitigation requirements for protection of species listed under the Endangered Species Act (ESA), without broader scale context. Thus, for Alternative S1, the individual mitigation requirements may be more varied, and more restrictive in total, than the management direction, A1/A2/T habitat designations, and restoration focus of Alternatives S2 and S3.

Federal Trust Responsibility and Tribal Rights and Interests

- Generally, Alternatives S2 and S3 would provide the best approach to appropriate government-to-government consultation because of more consistent and effective consultation direction.
- Both Alternatives S2 and S3 would provide more opportunities for tribal involvement in both planning and decision-making processes than Alternative S1. Alternative S2, with more extensive requirements for analysis at finer scales, would provide increased opportunities for tribal involvement in planning processes over Alternative S3. While Alternative 3's increased emphasis on restoration actions near reservations and tribal communities may provide for greater consultation opportunities in project decision-making, the

difference is negligible since Alternative S2 would have more restorative actions overall. Therefore, Alternative S2 would likely provide more opportunities for tribal consultation and involvement than Alternatives S1 or S3.

- Alternative S2 appears to be most responsive to honoring the federal trust responsibility and consideration of tribal rights and interests because it would provide more upfront direction (processes and prescriptions) and therefore better certainty to tribes of consistent and accountable implementation.
- Alternatives S2 and S3 both would respond better than Alternative S1 to protection and/or restoration of identified species of interest to tribes, with Alternative S2 being somewhat more responsive than Alternative S3.
- Alternatives S2 and S3, because of their broad-scale landscape, terrestrial, aquatic, economic, and restoration strategies, appear most responsive to the restoration of ecological processes as well as consideration of tribal resource concerns. Alternative S3 would provide a better response than Alternative 2 to some social and economic concerns by emphasizing more high restoration priority subbasins that are also high priority tribal subbasins. However, Alternative S2, with a higher rate and intensity of restoration and more analysis to target restoration at lower scales, is predicted to be more responsive than Alternative S1 and somewhat more responsive than Alternative S3 in addressing most social and biophysical concerns.

Social and Economic Considerations

Methodology: How Social and Economic Effects Were Estimated

The main sources of information for evaluation of the effects of the alternatives in this Supplemental Draft EIS include: Socioeconomic Evaluation of the EIS Alternatives (Crone and Haynes 1999), the Economic and Social Conditions of Communities (ICBEMP 1998), and Developing Measures of Socioeconomic Resiliency in the Interior Columbia Basin (Horne and Haynes 1999). This section of Chapter 4 blends the findings of the economics and social science staffs of the Science Advisory Group with additional analysis and interpretation provided by the EIS Team.

Science Advisory Group Economics Evaluation

The SAG's landscape and modeling scientists estimated 10-year and 100-year outputs that are expected to be produced from the Supplemental Draft EIS alternatives. Outputs included forage for livestock grazing produced, measured as Animal Unit Months (AUMs); timber volume harvested; acres of forest/woodland and rangelands restoration; and acres of prescribed fire and fuels management treatments. The SAG's economics staff (Crone and Haynes 1999) analyzed and presented economic activity and estimated outputs related to implementation of the Supplemental Draft EIS alternatives, and they calculated employment that would be associated with those output and activity levels.

For this Supplemental Draft EIS, because of the broad scale of the analysis, there were no economic benefits or costs of production calculated, other than for budgeting purposes, and no economic efficiency analysis was undertaken.

Science Advisory Group/Science Integration Team Social Science Evaluation

The Science Integration Team social science staff evaluation conducted for the Draft EISs (Burchfield, Allen, and McCool 1997) was based primarily on information collected through a panel process set up to support a Social Impact Analysis. Three panels were conducted. Two separate panels for the two EIS planning areas consisted of a variety of interest groups, consultants, college professors, county commissioners, sociologists, community development specialists, and state representatives. The third panel consisted of representatives from 14 tribes in the project area. Social impact analyses are usually conducted for more site-specific projects where the scope of activities and their effects can be understood.

The broad-scale plan of the Draft EISs could not provide the understanding that panelists felt they needed to evaluate social effects, except in the broadest terms. Also, attempts by the panels to estimate social effects were impeded by minimal information about how plans would be implemented

Major Changes from the Draft EISs

Changes from the Draft EISs were made in the outputs (such as AUMs and board feet), activities, and economics sections, along with more information on potential effects on isolated and economically specialized communities and tribal communities.

The social effects for this Supplemental Draft EIS relies on, and is very similar to that of the Draft EISs, with additional discussions by the SAG economics and social staff on potential county and community effects, tribal concerns, and environmental justice. Outputs were estimated for the entire project area, as modified since the Draft EISs, and by RAC/PAC, which replaced Bureau of Economic Analysis economic subregions, or trade areas.

and what the economic impacts might be, and by questions of financial and operational feasibility of the alternatives.

Because the Supplemental Draft EIS is also at a broad scale, there was no more specific information on implementation and effects available than for the Draft EISs. The report by Reyna (1998) did provide additional current condition information at the community level, identifying and classifying communities in the basin according to their economic specialization and whether they are isolated or not isolated. This information, along with Horne and Haynes' (1999) work on socio-economic resiliency at the county level, provided a way for the SAG to include more discussion about possible effects of changing output and activity levels on rural and tribal isolated and economically specialized communities, and on factors that influence socio-economic resiliency over the long run. Information and assessments related to attitudes, beliefs, values, quality of life, lifestyle, and sense of place are essentially the same as for the Draft EISs.

Additional EIS Team Effects Evaluation

Factors used by both the SAG and the EIS Team to estimate effects included existing conditions, objectives, standards, and modeled management prescriptions.

The EIS Team economics staff used the evaluation from the SAG, along with the ICBEMP (1998) and Horne and Haynes (1999) reports to assess, in general terms, potential effects of the alternatives on local communities. Of particular interest were rural and tribal communities that are isolated and economically specialized in economic sectors that rely on resources from, or management of, federal lands.

The broad scale of the modeling and analysis means that management prescriptions in the model are not tied to specific locations within the basin. It is not appropriate, given the coarseness of the data base to estimate effects directly by administrative unit, subbasin, or a smaller unit. As such, the discussion of effects is of necessity relatively broad, and not site- or area-specific.

The EIS Team used a variety of information that relates RAC/PAC areas to counties, subbasins, and communities. The effects discussions at those levels provide general trends and likely potential consequences based on community types or groups. However, specific estimates of changes in outputs or activity levels for a particular county, administrative unit, or community will have to come during mid-scale analyses done during the step-down process (such as Subbasin Review and revision of Forest Service and BLM land use plans).

Effects of the Alternatives on Annual Level of Goods and Services

Outputs and activities were analyzed for the next 10 years (the short term). For the economic and social analyses, the output and activity levels projected from the CRBSUM model in the tenth decade were not carried forward into the environmental consequences chapter. It was felt that for economic and social conditions, any attempt to assess effects 100 years into the future would be misleading because of the many changes that occur to economies and societies over a century.

The effects on specific communities or counties from changing supplies of timber and forage for livestock grazing, as well as potential employment through restoration work, could not be predicted for reasons that have been previously described. However, the SAG and the EIS Team used a variety of information that relate RAC/PACs to counties, subbasins, and communities to provide general trends and potential consequences at the local level for groups or types of communities.

Levels of Outputs and Management Activities Expected from the Alternatives

While goods and services provided from Forest Service- and BLM-administered lands potentially represent a large array of benefits, five major outputs and activities are quantified here, including two commercially marketable outputs and three types of ecological restoration activity:

- Livestock animal unit months (AUMs), representing the number of domestic livestock that graze on Forest Service- and BLM-administered rangelands;
- Wood volume produced from timber harvest and vegetation management actions measured in millions of board feet (mmbf);
- Acres of forest/woodland restoration activity, including planting (reforestation) and precommercial thinning;
- Acres of rangeland restoration activity; and
- Acres of prescribed fire and fuels management treatments to restore vegetation conditions that more closely reflect historical ranges, and to reduce risk of uncharacteristically severe wildfires.

Table 4-33 displays the average annual amount of outputs and activities for each alternative for the first decade. Next, tables with outputs and activities by RAC/PAC are shown with discussions of each output or activity. Discussions address how output and activity levels were determined, the uncertainty associated with their production, and other factors relevant to interpreting effects of these expected numbers. Later in this section, estimates of employment associated with the output and activity levels are displayed for the project area and by RAC/PAC.

The first priority of Alternatives S2 and S3 is restoration of ecosystems and watersheds. Production of market and non-market (priced and non-priced) goods and services for human use (timber, domestic livestock grazing, recreation, minerals, etc.) is also an important consideration, but only within the capabilities and limits of healthy ecosystems.

In addition to the timber and livestock grazing benefits quantified above, other benefits would be provided through restoration activities designed to move current ecosystem conditions to the desired condition. The expected ecological outcomes from restoration activities are not easily quantified, either biophysically or economically; however, if they were successfully quantified they would show that valuable direct and indirect benefits (such as healthier plant and wildlife populations, cleaner water, cleaner air, lower soil productivity loss) would be provided. Along with ecological benefits, restoration activities also make an important human contribution through generating employment and economic activity.

Table 4-33. Estimated Average Annual Output/Activity Levels, by Alternative.[1]

Output or Activity (units)	Alternative S1	Alternative S2	Alternative S3
Animal Unit Months (AUMs)	3,111,000	2,798,000	2,765,000
Timber Harvest Volume (mmbf)	810	990	980
Forest/Woodland Restoration (acres)	142,000	199,000	192,000
Rangeland Restoration (acres)	3,074,000	3,339,000	3,183,000
Prescribed Fire/Fuels Management (acres)	181,000	1,456,000	1,110,000

Abbreviations used in this table:
mmbf = million board feet

[1]AUMs and acres rounded to nearest thousand; mmbf rounded to nearest ten.

Source: Crone and Haynes 1999.

Livestock AUMs

Production Levels

Estimated domestic livestock use on Forest Service- and BLM-administered lands, measured in AUMs, is shown in Table 4-34 by RAC/PAC for each alternative.

Figures are estimated annual average use for the first decade after plan implementation. AUMs were calculated as part of the CRBSUM modeling process, discussed in the landscape section of this chapter. Prescriptions designed to reflect objectives, standards and management priorities were applied to areas as defined by each alternative, with resulting effects on the quality, or health, of rangelands estimated by the model. Investments in rangeland improvements and changes in rangeland management practices are expected to improve quantity of forage, as well as the quality of the rangelands, although only the latter was modeled.

While these modeling estimates do not state the total forage that could be produced in the basin, the AUMs shown in Table 4-33 are an estimate of the sustainable grazing that could be allowed as a consequence of management direction implemented for watershed and ecosystem protection and restoration. Management direction does not require certain levels of permitted livestock grazing. Rather, it describes desired rangeland conditions. Therefore, changes in AUMs are indirect consequences, rather than prescribed outcomes, of this direction. Estimated grazing is reported and discussed only for the first decade of plan implementation.

The projected decline in AUMs does not reflect any possible future changes in the structural nature of the livestock industry, such as shifts in the share of range feeding vs. stockyard feeding for cattle, shifts in the culture and economics or ranching, or the withdrawal and conversion of lands from ranching to other types of development (such as resorts, housing

Table 4-34. Projected Animal Unit Months (AUMs), by RAC/PAC and Alternative, Annual Average First Decade, Project Area and All Lands.[1]

RAC/PAC	Alt. S1	Alt. S2	Change from S1 AUMs	Change from S1 %	Alt. S3	Change from S1 AUMs	Change from S1 %
Project Area (FS-BLM Lands)							
Butte RAC	38,000	34,700	-3,300	-9	34,300	-3,700	-10
Klamath PAC	42,800	39,300	-3,500	-8	39,700	-3,100	-7
Deschutes PAC	113,600	95,300	-18,300	-16	91,300	-22,300	-20
John Day-Snake RAC	347,400	324,100	-23,300	-7	311,500	-35,900	-10
Southeastern Oregon RAC	765,500	697,800	-67,700	-9	681,100	-84,400	-11
Lower Snake River RAC	581,000	546,500	-34,500	-6	545,300	-35,700	-6
Upper Snake River RAC	741,100	609,800	-131,300	-18	616,200	-124,900	-17
Upper Columbia-Salmon Clearwater RAC R4	365,800	337,200	-28,600	-8	334,400	-31,400	-9
Eastern Washington	65,100	63,900	-1,200	-2	61,800	-3,300	-5
Yakima PAC	3,900	3,700	-200	-5	3,800	-100	-3
Eastern Washington Cascades	12,400	12,300	-100	-1	12,300	-100	-1
Upper Columbia-Salmon Clearwater RAC R1	34,000	33,700	-300	-1	33,700	-300	-1
Total - Project Area	3,110,600	2,798,300	-312,300	-10	2,765,300	-345,300	-11
All Lands							
Total - All Lands	45,752,000	45,439,600	-312,400	-1	45,406,700	-345,300	-1

Abbreviations used in this table:
RAC = Resource Advisory Council
PAC = Provincial Advisory Committee
Alt. = Alternative
FS = Forest Service
BLM = Bureau of Land Management
R1 = Forest Service Northern Region
R4 = Forest Service Intermountain Region

[1] Sums of columns may not equal totals because of rounding.

Source: Crone and Haynes 1999.

developments, and the like). Some or all of these types of changes may occur, with effects on the livestock grazing industry in the basin. However, they are outside the control of the agencies and were not modeled.

Livestock grazing use projected for Forest Service- and BLM-administered lands under Alternatives S2 and S3, compared to continuation of current management in Alternative S1, would be expected to decrease 10 percent and 11 percent, respectively. The effect compared to total grazing use on all ownerships would be much smaller—less than one percent decrease for either alternative. The projected decline in grazing from implementation of Alternative S2 or Alternative S3 confirms the USDA/USDI 1994 projection of reductions in grazing use over the next two decades to protect rangelands from further degradation and to provide protection for habitats of listed species (see Chapter 2). That process started with the implementation of PACFISH, INFISH, and Healthy Rangelands direction, and it would continue with implementation of either of the action alternatives.

With Alternatives S2 and S3, all RAC/PACs would see a decline in AUMs on Forest Service- and BLM-administered lands. The changes in grazing levels from Alternative S1 are not consistent among the RAC/PACs in magnitude.

While the overall decrease in grazing levels for the ICBEMP project area is somewhat larger for Alternative S3 than for Alternative S2, only 7 of the 12 RAC/PACs would actually experience greater declines in Alternative S3. Three RAC/PACs would show smaller declines in Alternative S3 compared to Alternative S2; the other 2 RAC/PACs would see no difference in grazing levels. These variations between the two alternatives reflect the differences among RAC/PACs in geographic extent of A1/A2 subwatersheds, T watersheds, and riparian conservation areas in conjunction with the difference in focus, amount, and location of restoration activities.

While the total effect on basin-wide grazing use from either Alternative S2 or Alternative S3 would be very small, there could still be impacts at the local level in some areas. Those ranching operations that are most dependent on grazing Forest Service- and BLM-administered range allotments would be likely to feel a more substantial effect from changes in AUMs from these lands. (See Community Effects discussion later in this section.)

Predictability and Sustainability of Livestock Production

Although projected grazing use was drawn in part from livestock-oriented management direction, this direction was assigned to improve ecosystem conditions, not to achieve a particular livestock production objective. Improving ecological conditions on rangelands depends on application of grazing systems, managing season of use, and investing in range improvements as well as on control of the number of livestock grazed. While Alternative S1 would continue current livestock and grazing management practices under PACFISH, INFISH, and other existing management direction from land use plans, Alternatives S2 and S3 would implement more comprehensive, landscape-scale livestock and grazing management practices. This may introduce additional uncertainty in forage and livestock production compared to continuation of current practices. As shown in Table 4-34, changes in amounts of grazing use (AUMs) could be expected from implementing Alternatives S2 and S3.

Both private livestock operators and the agencies would face some additional costs for management of rangeland and livestock grazing if either Alternative S2 or S3 were selected, above those cost increases that have already been incurred with the implementation of PACFISH, INFISH, and Healthy Rangelands management direction. At this broad-scale, it was not possible to estimate costs for implementing new, potentially more intensive management practices for livestock operators; however, costs were estimated for the rangeland restoration and maintenance work associated with each alternative. Those costs currently average \$0.10 per acre. They are estimated to be \$0.40 per acre for high restoration priority subbasins and \$0.15 per acre for the other subbasins (Crone and Haynes 1999). Additional mid-scale analysis should provide information on the expected magnitude of additional costs of rangeland management, livestock grazing, and rangeland restoration, as well as their distribution between the livestock operators and agencies.

If short-term uncertainty for livestock operators is assumed to increase with the implementation of new management direction, then the most to least predictable alternative in the short term would be Alternatives S1, S2, and S3. There is little difference between Alternatives S2 and S3. The major source of additional uncertainty in Alternative S3 would be potentially more stringent consultation requirements and mitigation measures at the individual project and allotment levels, because Alternative S3 requires less Ecosystem Analysis at the Watershed Scale (EAWS) than Alternative S2.

Over time, predictability for Alternatives S2 and S3 should improve as new allotment management plans are completed, rangeland conditions improve, and operators adjust to new direction. Short-term effects

on the ranching industry that could result from proposed changes include: financially marginal operators departing, financially stable operators becoming marginal, and larger or more efficient operators buying out smaller or less efficient ones.

Recreation

The prediction in the Draft EISs of future recreation use on Forest Service- and BLM-administered lands was based on the interaction of supply (the number of acres in each Recreation Opportunity Spectrum [ROS] class) and demand (human population growth and demographic change). Little change in distribution of acres among ROS classes was projected in the short term, and change thereafter was predicted to be modest. Population growth would be the dominant factor affecting the type and amount of recreation uses during the next 10 years. In the longer term, demographic changes (especially an aging population) would become increasingly important.

For the Supplemental Draft EIS, the CRBSUM model predicted almost no change in distribution of ROS acres across the landscape in the short term. Also, changes in road conditions, locations, and accessibility—critical to the assessment of recreation supply and use patterns—were not modeled at this broad scale. Finally, potential effects of objectives and standards to protect and restore aquatic and riparian habitats, such as those for riparian conservation areas, could not be modeled at the broad scale, because they rely on more site- and condition-specific information.

Therefore, changes in recreation use were not predicted. Changes in recreation supply and expected use will be estimated and effects evaluated at the mid scale during the step-down process (Subbasin Review, EAWS, and land use planning), where more specific information will be available.

Timber Volume

Timber Production Calculations

Estimated average annual timber production for the first decade from Forest Service- and BLM-administered lands, measured in millions of board feet (mmbf), is shown in Table 4-35 by RAC/PAC. Percentage changes in timber harvest levels from Alternative S1 to Alternatives S2 and S3 are also shown.

Timber production was calculated as part of the CRBSUM modeling process, discussed in the landscape section earlier in this document. Prescriptions reflecting objectives, standards and priorities were assigned in the CRBSUM model. Timber production levels were projected based on acres to be treated by timber harvesting (commercial thinning and final harvest) to achieve the objectives of the alternatives. Timber production is not prescribed by the management direction. It results from the restoration activities conducted to achieve the desired outcomes expressed in the management direction. Because of the broad-scale basis of the CRBSUM model and its underlying data, timber harvest levels were projected for the project area as a whole and for each RAC/PAC area.

Timber production estimates are based on simulations of natural disturbance and succession processes (including natural fire and vegetation growth) as well as human management of fuels and vegetation. This method is different from traditional timber scheduling models (see Table 4-36). Refined estimates of timber supply and sustainability need to be completed by individual national forests and BLM districts as they adjust their land use plans. Until then, these initial projections provide estimates of the relative differences among the alternatives at the broad scale.

As a result of the restoration and maintenance of sustainable ecosystems, most of the commercially saleable volume in the first decade is expected to come from the large amounts of forest and woodland restoration work proposed, particularly in Alternatives S2 and S3. These trees will generally be smaller and of poorer quality than what has typically been harvested commercially in the past.

Timber Production Levels

Timber production estimated for Forest Service- and BLM-administered lands under Alternatives S2 and S3 compared to Alternative S1, would change by almost the same amounts, rising by about 172 mmbf and 167 mmbf (approximately 21 percent), respectively. The effect compared to total timber production from all ownerships would be much smaller—an increase of about five percent for either alternative.

Table 4-35 shows estimated projected timber harvest levels for the project area and by RAC/PAC area.

With Alternative S2, all RAC/PACs except the Eastern Washington RAC would see an increase in timber harvest levels compared to Alternative S1. In Alternative S3, all RAC/PACs would see an increase in timber harvest levels from Forest Service- and BLM-administered lands, compared to Alternative S1.

Among the RAC/PACs, the changes in harvest levels from Alternative S1 are not consistent in magnitude.

Table 4-35. Projected Timber Harvest (mmbf), by RAC/PAC and Alternative, Annual Average First Decade,[1] Project Area and All Lands.

RAC/PAC	Alt. S1	Alt. S2	Change from S1 mmbf	Change from S1 %	Alt. S3	Change from S1 mmbf	Change from S1 %
Project Area (FS-BLM Lands)							
Butte RAC	161	174	13	8	172	11	7
Klamath PAC	41	51	10	24	51	10	24
Deschutes PAC	56	57	1	2	59	3	5
John Day-Snake RAC	122	190	68	56	178	56	47
Southeastern Oregon RAC	73	99	26	36	90	17	23
Lower Snake River RAC	42	59	17	40	64	22	52
Upper Snake River RAC	12	14	2	17	14	2	17
Upper Columbia-Salmon Clearwater RAC R4	116	145	29	25	140	24	21
Eastern Washington	49	48	-1	-2	52	3	6
Yakima PAC	0	1	1	nc	1	1	nc
Eastern Washington Cascades	3	4	1	33	5	2	67
Upper Columbia-Salmon Clearwater RAC R1	138	144	6	4	155	17	12
Total Project Area	814	986	172	21	981	167	21
All Lands							
Total All Lands	3,355	3,527	172	5	3,522	167	5

Abbreviations used in this table:
RAC = Resource Advisory Council
PAC = Provincial Advisory Committee
Alt. = Alternative
mmbf = million board feet
nc = not calculable
FS = Forest Service
BLM = Bureau of Land Management
R1 = Forest Service Northern Region
R4 = Forest Service Intermountain Region

[1]Sums of columns may not equal totals because of rounding.

Source: Crone and Haynes 1999.

While the overall increase for the ICBEMP project area would be similar for Alternatives S2 and S3, four of the RAC/PACs would experience larger increases in Alternative S2, compared to Alternative S3. Three RAC/PACs would not change between the two alternatives, while the others would show smaller increases in Alternative S2 compared to Alternative S3. These variations between the two alternatives reflect the differences among RAC/PACs in locations and sizes of A1/A2 subwatersheds, T watersheds, and RCAs in conjunction with the difference in focus, amount, and location of restoration activity using timber harvest as a management tool and the size of the timber resource base.

While the total effect on basin-wide production of timber from Forest Service- and BLM-administered lands from Alternative S2 or S3 would be relatively small (about a five percent increase), there would be larger or smaller impacts in some localized areas. Those timber harvest and milling operations that are most dependent on wood from Forest Service- and BLM-administered lands would likely feel a more substantial effect from changes in timber harvest from agency lands. (See community effects discussion later in this section.)

Predictability and Sustainability of Timber Harvest Volume Levels

The projected timber harvest volumes displayed in Table 4-35 are not based on more traditional timber harvest modeling methods. Rather, they are based on the broad-scale landscape disturbance and succession approach, which expands the meaning of sustainability to include all components and processes

Table 4-36. Comparison of Modeling Methods with Regard to Sustainability and Predictability of Timber Harvest Levels.

Projecting Timber Outputs in Conventional Modeling	Projecting Timber Outputs in ICBEMP Broad-scale Landscape Disturbance Modeling
Management intensity and timber harvest rates are based on a formal system designed to provide predictable timber volume outputs.	System is adapted to accommodate new management approaches designed to provide more predictable landscape disturbance outcomes.
Sustained yield of wood fiber is used as a formal measure of sustainability based on the premise that sustained timber yield, properly constrained and mitigated, would sustain the underlying forest processes.	Sustained yield of wood fiber is still important, but not as a formal measure of sustainability. Sustainability is more broadly defined to account for ecosystem functions, processes, and landscape disturbance.
Assumes static ecosystems.	Assumes dynamic ecosystems.
Pattern, timing, and type of disturbance are designed to support sustained yield of wood in perpetuity by managing the age, size, species, and development of forest growing stock.	Pattern, timing, and type of disturbance are designed to support desired disturbance patterns and ecosystem processes and conditions by managing cover types and structural stages across the landscape.

of ecosystems and to account for the role of disturbance regimes in shaping how ecosystems change over time. Some key differences between conventional timber modeling and the landscape approach used in this EIS are displayed in Table 4-36. Refined estimates of timber supply will be determined when the selected alternative is incorporated into local Forest Service and BLM land use plans.

Shifting management objectives and silvicultural prescriptions from a timber production emphasis to a restoration emphasis would change both the nature of the timber product removed from the forest and the cost of removing it. Log size, log quality, and volume per acre removed are critical to the profitability of harvest operations and lumber manufacturing. Average diameter of trees removed has been shown especially important to the financial feasibility of a timber sale (Crone and Haynes 1999).

Achieving the levels of timber harvest projected, as shown in Table 4-35, assumes that all the estimated available volume will be sold. However, an emphasis on the restoration work prescribed to produce desirable stand structures and other ecosystem characteristics would generally result in harvesting smaller diameter trees and producing less volume per acre. Restrictions on the removal of large trees will have similar results. As noted earlier, both log size and volume per acre removed are critical to the profitability of harvest operations and lumber manufacturing. These factors, along with the use of higher cost logging systems would have a higher risk of not being sold than would the prescriptions in Alternative S1. An unsold timber sale either delays the accomplishment of restoration objectives or shifts the restoration work from a timber sale to a service contract, which is generally a higher cost option.

These factors raise uncertainty about the timber harvest projections under Alternatives S2 and S3. However, the amount of timber that is offered for sale and how it is marketed is also a key determinant of how much timber is ultimately sold. Differences in marketing practices among national forests have shown major differences in timber sale success. Therefore, different marketing approaches can mitigate the uncertainty associated with timber harest projections. There is little uncertainty associated with the volume projected for Alternative S1; it is based on actual timber harvests and is the result of current marketing practices.

Forest and Rangeland Restoration Activity Levels

Maintenance and restoration of watersheds and terrestrial habitats constitute a major focus of Alternatives S2 and S3. Restoration work is expected to provide both biophysical and socio-economic benefits. Ecosystem structure, function, and process would be anchored and maintained where already in good shape, and will be strengthened and restored where degradation has occurred. At the same time, restoration project expenditures would provide additional employment in local areas (see Employment section).

On-the-ground restoration activities that were not modeled will be identified during the step-down process through national forest/BLM land use planning, Subbasin Review, EAWS, and site-specific NEPA analyses. These types of restoration activities include road treatments (decommissioning, closures, stormproofing, and upgrading), and in-stream and stream channel improvements.

Forest/Woodland Restoration Activity Levels

Forest and woodland restoration activities that were modeled include planting after timber harvest and precommercial thinning. Expected acres of restoration activity to be carried out each year over the first decade are displayed for the project area and by RAC/PAC in Table 4-37.

The total amount of forest/woodland restoration activity, including both harvest and precommercial thinning, would increase substantially compared to Alternative S1: about 40 percent for Alternative S2 and almost 35 percent for Alternative S3.

With Alternatives S2 and S3, all RAC/PACs would see an increase in acres of forest/woodland restoration activity compared to Alternative S1.

Table 4-37. Acres of Projected Forest/Woodland Restoration Activity[1] by RAC/PAC and Alternative, Average Annual First Decade, Project Area. [2]

RAC/PAC	Alternative S1	Alternative S2	% Change from S1	Alternative S3	% Change from S1
Butte RAC	26,300	33,700	28	33,400	27
Klamath PAC	11,300	14,400	27	14,300	26
Deschutes PAC	12,600	15,400	22	15,000	19
John Day-Snake RAC	21,400	38,500	80	35,300	65
Southeastern Oregon RAC	17,600	26,300	49	23,100	31
Lower Snake River RAC	6,100	10,200	67	10,200	67
Upper Snake River RAC	2,100	3,700	76	3,500	67
Upper Columbia-Salmon Clearwater RAC R4	19,000	24,200	27	23,700	25
Eastern Washington	7,300	8,600	18	9,200	26
Yakima PAC	100	100	0	100	0
Eastern Washington Cascades	600	1,100	83	1,200	100
Upper Columbia-Salmon Clearwater RAC R1	17,300	22,500	30	23,000	33
Total Project Area (FS-BLM Lands)	141,700	198,600	40	192,200	36

Abbreviations used in this table:
RAC = Resource Advisory Council
PAC = Provincial Advisory Committee
R1 = Forest Service Northern Region
R4 = Forest Service Intermountain Region

[1] Includes post-harvest reforestation and precommercial thinning.
[2] Sum of columns may not be equal totals because of rounding.

Source: Crone and Haynes 1999

Among the RAC/PACs, the changes in harvest or restoration levels from Alternative S1 to Alternatives S2 and S3 are not consistent in magnitude. Most of the RAC/PACs would follow the basin-wide pattern of more restoration acres under Alternative S2 than Alternative S3. However, three of the RAC/PACs have fewer projected restoration acres in Alternative S2 than Alternative S3. The differences by RAC/PAC between the two action alternatives can be attributed to differences in locations and sizes of A1/A2 subwatershed areas and riparian conservation areas by alternative, in conjunction with the difference in focus, amount, and location of restoration activity. In addition, restoration is distributed across 11 more high restoration priority subbasins in Alternative S3 than in Alternative S2.

At the basin scale, changes in planting from Alternative S1 to Alternatives S2 and S3 follow the pattern of the total forest/woodland restoration activity levels, as well as the pattern of timber harvest volume: both alternatives would show increases from Alternative S1, but Alternative S2 would show a slightly greater increase than Alternative S3.

Table 4-38 shows the planting portion of the total forest/woodland restoration activity for the project area and by RAC/PAC. Acres to be planted are based on the harvest acres requiring reforestation, as modeled in CRBSUM.

At the basin scale, changes in precommercial thinning from Alternative S1 to Alternatives S2 and S3 would follow the pattern of the total forest/woodland restoration activity levels: both alternatives would show increases from Alternative S1. In this case, Alternative S2 would have a significantly larger percentage increase than Alternative S3, although the numeric difference of just under 4,000 acres basin-wide is not as large as the percentage difference might suggest.

In summary, Alternatives S2 and S3, respectively, would increase planting and precommercial thinning acres similarly. Planting would increase just under 28,000 acres for Alternative S2 and just over 25,000 acres for Alternative S3. Precommercial thinning acres would increase 29,000 acres in Alternative S2 and just over 25,000 acres for Alternative S3. (Note that the percentage changes in precommercial thinning acres, as shown in Table 4-39, are much larger than for planting acres because they begin with a substantially lower base.)

Rangeland Maintenance and Restoration Activity Levels

Rangeland maintenance and restoration activities are currently occurring (Alternative S1). However, under the two action alternatives, acres treated each year in the first decade would increase, by about nine percent in Alternative S2 and four percent in Alternative S3. Rangeland restoration activities may include prescribed burning, weed control, mechanical treatments, thinning, and seeding. Expected acres of restoration activity to be carried out each year over the first decade are displayed for the project area and by RAC/PAC in Table 4-40.

For the basin as a whole, rangeland restoration activity would increase from the no-action alternative for both Alternatives S2 and S3, with Alternative S2 resulting in about 156,000 acres (or about five percent) more restoration than Alternative S3.

In general, the changes by RAC/PAC between Alternatives S2 and S3 would follow the same pattern as the project area as a whole. There is a smaller increase, or larger decrease, for Alternative S3 than for Alternative S2. The exceptions, both relatively minor, would be the Klamath and the Upper Snake River RACs.

Prescribed Fire and Fuels Management

The current ecological condition of many forested areas in the project area and their increased susceptibility to uncharacteristic wildfire are significant issues being examined through this EIS. Both action alternatives propose fuels management, prescribed fire, and wildland fire management direction to begin to move the condition of these forests toward their historical conditions. This would provide benefits in terms of reducing the risk of uncharacteristic wildfire and would promote recovery of terrestrial habitat that has been degraded or lost over the past century or more.

Expected acres of prescribed fire and fuels management activity each year over the first decade are displayed for the project area and by RAC/PAC in Table 4-41.

As can be seen from Table 4-41, substantial increases are proposed in prescribed fire and fuels management activities for both action alternatives compared to no-action levels. For the basin as a whole, Alternative S2

Table 4-38. Acres of Projected Post-Harvest Planting Activity[1] by RAC/PAC and Alternative, Average Annual First Decade, Project Area.[2]

	Alternative S1	Alternative S2	% Change from S1	Alternative S3	% Change from S1
RAC/PAC					
Butte RAC	17,500	19,400	11	19,100	9
Klamath PAC	10,000	12,400	24	12,400	24
Deschutes PAC	10,800	12,600	17	12,600	17
John Day-Snake RAC	19,600	29,600	51	27,800	42
Southeastern Oregon RAC	15,300	21,300	39	19,100	25
Lower Snake River RAC	5,400	7,600	41	8,300	54
Upper Snake River RAC	1,300	1,400	8	1,400	8
Upper Columbia-Salmon Clearwater RAC R4	15,300	18,200	19	17,900	17
Eastern Washington	5,000	5,000	0	5,400	8
Yakima PAC	0	100	nc	100	nc
Eastern Washington Cascades	500	600	20	700	40
Upper Columbia-Salmon Clearwater RAC R1	11,300	11,700	4	12,500	11
Total Project Area (FS-BLM Lands)	112,000	139,900	25	137,200	23

Abbreviations used in this table:
RAC = Resource Advisory Council
PAC = Provincial Advisory Committee
nc = not calculable
R1 = Forest Service Northern Region
R4 = Forest Service Intermountain Region

[1] Portion of total forest/woodland restoration activity.
[2] Sum of columns may not be equal totals because of rounding.

Source: Crone and Haynes 1999.

Table 4-39. Acres of Projected Pre-commercial Thinning Activity[1] by RAC/PAC and Alternative, Average Annual First Decade,[2] Project Area.

RAC/PAC	Alternative S1	Alternative S2	% Change from S1	Alternative S3	% Change from S1
Butte RAC	8,800	14,300	62	14,200	61
Klamath PAC	1,300	2,000	54	1,900	46
Deschutes PAC	1,700	2,700	59	2,400	41
John Day-Snake RAC	1,900	8,900	368	7,600	300
Southeastern Oregon RAC	2,300	5,000	117	4,000	74
Lower Snake River RAC	800	2,600	225	2,000	150
Upper Snake River RAC	800	2,200	175	2,100	163
Upper Columbia-Salmon Clearwater RAC R4	3,700	6,100	65	5,900	59
Eastern Washington	2,300	3,600	57	3,800	65
Yakima PAC	0	0	nc	0	0
Eastern Washington Cascades	100	500	400	500	400
Upper Columbia-Salmon Clearwater RAC R1	6,000	10,800	80	10,500	75
Total Project Area (FS-BLM Lands)	29,800	58,800	97	54,900	84

Abbreviations used in this table:
RAC = Resource Advisory Council
PAC = Provincial Advisory Committee
R1 = Forest Service Northern Region
R4 = Forest Service Intermountain Region

[1] Portion of total forest/woodland restoration activity.
[2] Sums of columns may not equal because of rounding.

Source: Crone and Haynes 1999.

Table 4-40. Acres of Projected Rangeland Maintenance and Restoration Activity by RAC/PAC and Alternative, Average Annual First Decade,[1] Project Area.

RAC/PAC	Alternative S1	Alternative S2	% Change from S1	Alternative S3	% Change from S1
Butte RAC	85,300	115,100	35	97,600	14
Klamath PAC	84,400	66,200	-22	66,500	-21
Deschutes PAC	167,100	144,700	-13	135,900	-19
John Day-Snake RAC	305,000	377,400	24	349,600	15
Southeastern Oregon RAC	1,115,200	1,144,200	3	1,092,900	-2
Lower Snake River RAC	445,600	507,800	14	484,600	9
Upper Snake River RAC	516,900	539,900	4	550,400	6
Upper Columbia-Salmon Clearwater RAC R4	278,600	315,600	13	299,600	8
Eastern Washington	33,000	54,200	64	47,900	45
Yakima PAC	900	1,000	11	1,000	11
Eastern Washington Cascades	9,200	11,500	25	9,700	6
Upper Columbia-Salmon Clearwater RAC R1	32,700	61,500	88	47,500	45
Total Project Area (FS-BLM Lands)	3,074,100	3,339,200	9	3,183,300	4

Abbreviations used in this table:
RAC = Resource Advisory Council
PAC = Provincial Advisory Committee
R1 = Forest Service Northern Region
R4 = Forest Service Intermountain Region

[1]Sums of columns may not equal totals because of rounding.

Source: Crone and Haynes 1999.

would have about 350,000 acres of treatment per year more than Alternative S3.

Table 4-41 also shows the expected percentage changes in acres to be treated under either Alternative S2 or S3, compared to Alternative S1. As can be seen, the increases would be substantial on this basis.

Special Forest Products

The effects of the alternatives on various special forest products—such as mushrooms, berries, ferns, and boughs—were not estimated. As mentioned in Chapter 2, special forest products are a small but growing industry, estimated already to be producing several hundred million dollars annually in sales. The demand for these products has been growing rapidly, from both within and outside the project area.

Several national forests and BLM districts have some management controls on harvesting some types of special forest products. The same type of varying management direction would continue under Alternative S1. Alternatives S2 and S3 would apply landscape-scale ecosystem maintenance and restoration objectives to agency lands throughout the basin. Because knowledge of special forest products depends on site-specific information, the effects of management activities on special forest products will be analyzed at a finer scale during the step-down process (includi g land use plan adjustments, Subbasin Review a d EAWS, and project-level NEPA analysis

Permitted Mineral and Energy Operatio

Broad-scale effects on mineral and energy explorati n and development were not estimated for this EIS a d can only be inferred from management direction th t could hinder potential operation

Standards and guidelines to protect aquatic a d riparian areas already in place on most Forest Service- and BLM-administered lands through PACFI H and INFISH, as well as additional aquatic a d riparian protection under Alternatives S2 and S , may increase the cost of mining and energy developments by limiting the location (or requiring relocation) of mining operations and facilities (such as mi l buildings, settling ponds, sanitary and solid was e structures, and overburden piles). Alternatives 2 and S3 may require relocating access roads or changing mine design and operation to avoid impacts o riparian area

Table 4-41. Projected Acres of Prescribed Fire and Fuels Management, by RAC/PAC and Alternative, Annual Average First Decade,[1] Project Area.

RAC/PAC	Alt. S1	Alt. S2	Change from S1 Acres	Change from S1 %	Alt. S3	Change from S1 Acres	Change from S1 %
Butte RAC	24,400	211,800	187,400	768	200,900	176,500	723
Klamath PAC	13,100	43,300	30,200	231	37,200	24,100	184
Deschutes PAC	24,300	79,400	55,100	227	80,200	55,900	230
John Day-Snake RAC	46,400	484,800	438,400	945	366,500	320,100	690
Southeastern Oregon RAC	33,900	313,000	279,100	823	182,100	148,200	437
Lower Snake River RAC	2,600	26,100	23,500	904	10,700	8,100	312
Upper Snake River RAC	3,500	17,300	13,800	394	18,600	15,100	431
Upper Columbia-Salmon Clearwater RAC R4	17,700	98,700	81,000	458	84,800	67,100	379
Eastern Washington	2,600	33,500	30,900	1,188	26,500	23,900	919
Yakima PAC	0	100	100	nc	0	0	nc
Eastern Washington Cascades	800	14,300	13,500	1,688	10,800	10,000	1,250
Upper Columbia-Salmon Clearwater RAC R1	11,700	134,200	122,500	1,047	91,400	79,700	681
Total Project Area (FS-BLM Lands)	181,100	1,456,400	1,275,300	704	1,109,900	928,800	513

Abbreviations used in this table:
RAC = Resource Advisory Council
PAC = Provincial Advisory Committee
Alt. = Alternative
R1 = Forest Service Northern Region
R4 = Forest Service Intermountain Region

[1]Sums of columns may not equal totals because of rounding.

Source: Crone and Haynes 1999.

Effects of the Alternatives on Employment

Background

Direct employment generated from Forest Service- and BLM-administered lands falls mostly into job categories such as wood products manufacturing, livestock grazing, forestry services, mining, federal employment, and recreation related retail trade and services. Together, these employment categories are most likely to be affected as a result of changing federal land uses. In Chapter 2 it was noted that about 95,000 jobs are associated with livestock grazing, recreation, and timber harvest on lands administered by the Forest Service or BLM in the project area. It was estimated that recreation accounts for 81 percent of these jobs, timber harvest for 9 percent, livestock grazing for 1 percent, and various forestry services for the remaining 8 percent (Crone and Haynes 1999).

The reader may notice a difference between the total direct employment figure of approximately 8,100 in Table 4-42, and the total of about 18,000 direct jobs associated with outputs and activities (other than recreation) on Forest Service- and BLM-administered lands that would be calculated from the figures in the previous paragraph. The difference of almost 10,000 jobs can be attributed primarily to the different base years on which the figures were calculated (1995–1997 for Table 4-42, and 1993–1994 for the revised Crone and Haynes (1999) figures, and to the area over which the employment figures were calculated. The Crone and Haynes figures are based on the entire Columbia River Basin assessment area, while the figures in Table 4-42 are based on just the current Supplemental Draft EIS project area. Also, during 1995–1997, the basin timber harvest from agency lands fell by about one billion board feet, which would have supported nearly 8,000 jobs.

Differences in employment levels by alternative are identifiable for several, but not all of these employment categories. The categories where changes in employment by alternative are discernable include timber, grazing, forestry services including range restoration, and prescribed fire. The largest component, recreation, would have no identifiable difference in use levels across the alternatives for the next

decade. Therefore, recreation-related employment would be held constant. Mining employment would also be held constant since no differences in mining activity could be estimated among the alternatives.

The following discussion identifies the alternative employment effects in total and for those components where differences in direct employment could be determined. The indirect and induced employment effects resulting from the changes in direct employment are not included in order to focus on the initial employment changes associated with BLM- and Forest Service-administered lands.

Potential Effects

Total Employment

Employment opportunities would be augmented in Alternatives S2 and S3, resulting in job increases of about 4,000 and 3,000 jobs respectively in direct employment generated from Forest Service- and BLM-administered lands. These differences are displayed by RAC/PAC in Table 4-42. The increases represent a four percent gain in Alternative S2 and a three percent gain in Alternative S3 with respect to the total 95,000 jobs associated with Forest Service- and BLM-administered lands in the project area. Each of the components are described in more detail following this general discussion. All components would increase except for grazing-related employment.

When compared to Alternative S3, Alternative S2 would result in higher employment opportunities except for relatively small declines in a few RAC/PACs (Table 4-42).

Grazing-related Employment

Grazing-related employment is expected to decline somewhat across the project area and within most RAC/PACs, with the implementation of either Alternative S2 or Alternative S3, compared to continuation of current management practices under Alternative S1. Ranching employment could be reduced by about 112 to 125 jobs (10–11 percent), respectively (Table 4-43). This decline in employment would be associated with the projected decrease in grazing use resulting from implementation of the alternatives. It does not include any other employment effects that might take place as a result of structural, cultural, or land use changes in the livestock industry arising from conditions outside the agencies' control.

Only minor differences can be seen between Alternatives S2 and S3. The largest declines would be found in those RAC/PACs where BLM and Forest Service grazing is a significant resource use, because domestic livestock grazing stocking levels could decrease as an indirect consequence of meeting rangeland restoration and other landscape objectives.

Range jobs were calculated by multiplying the number of animal unit months (AUMs) under each alternative by 0.00036 jobs per AUM. This response coefficient for rangeland grazing employment includes an adjustment of 20 percent to account for seasonal use patterns of federal allotments (see Haynes and Horne 1997 for details).

Recreation-related Employment

No effects on levels of recreation use from implementing either of the action alternatives were predicted because of the broad scale of analysis (see Outputs and Activities/Recreation, earlier in this section). Therefore, no effects on recreation-related employment could be projected. Employment effects may be identified from subsequent finer-scale analyses during the step-down process.

Timber-related Employment

Timber-related employment associated with timber harvest and manufacture generated from Forest Service- and BLM-administered lands has declined for the past several years in the project area. Alternatives S2 and S3 would reverse this trend by increasing employment opportunities by about 1,300 jobs or 21 percent. This information is presented by RAC/PAC and by alternative in Table 4-44.

The cause of increase in timber and timber-related employment is the focus on restoration activities in substantially forested areas. Alternatives S2 and S3 differ in which RAC/PAC areas show increased employment because of the different areas where restoration would be focused. These projections are subject to the cautions identified previously: the quality of the timber being harvested and the costs of harvest activities may result in timber sales that are not economically viable, which may result in less timber being harvested and manufactured than estimated.

Direct timber employment is estimated by multiplying the timber harvest for each alternative by 7.75 jobs per million board feet. This factor was determined by dividing current employment in the wood and forest products industry by current timber harvest in the project area. No offsetting increases or decreases are assumed for other ownerships. Also, no job changes

Table 4-42. Total Direct Employment Associated with Activities (Other Than Recreation) on Forest Service- and BLM-administered Lands, by RAC/PAC and Alternative, Average Annual Number of Jobs.

RAC/PAC	Alt. S1	Alt. S2	Alt. S3	S2 Change from S1	S3 Change from S1
Butte RAC	1,363	1,854	1,806	491	453
Klamath PAC	385	525	513	140	128
Deschutes PAC	548	666	681	118	133
John Day-Snake RAC	1,207	2,639	2,301	1,432	1,094
Southeastern Oregon RAC	950	1,700	1,355	750	405
Lower Snake River RAC	552	729	738	177	186
Upper Snake River RAC	372	374	378	2	6
Upper Columbia-Salmon Clearwater RAC R4	1,105	1,493	1,424	388	319
Eastern Washington	420	477	494	57	74
Yakima PAC	4	10	9	6	5
Eastern Washington Cascades	31	67	69	36	38
Upper Columbia-Salmon Clearwater RAC R1	1,143	1,443	1,440	300	297
Total	8,080	11,977	11,218	3,897	3,138

Abbreviations used in this table:
BLM - Bureau of Land Management
RAC = Resource Advisory Council
PAC = Provincial Advisory Committee
Alt. = Alternative
R1 = Forest Service Northern Region
R4 = Forest Service Intermountain Region

Source: Crone and Haynes 1999.

Table 4-43. Grazing Direct Employment Related to Forest Service- and BLM-Administered Lands, by RAC/PAC and Alternative, Average Annual Number of Jobs.

RAC/PAC	Alt. S1	Alt. S2	Alt. S3	S2 Change from S1	S3 Change from S1
Butte RAC	13	12	12	-1	-1
Klamath PAC	15	14	14	-1	-1
Deschutes PAC	41	34	33	-7	-8
John Day-Snake RAC	125	117	112	-8	-13
Southeastern Oregon RAC	276	251	245	-25	-31
Lower Snake River RAC	209	197	196	-12	-13
Upper Snake River RAC	267	220	222	-47	-45
Upper Columbia-Salmon Clearwater RAC R4	132	121	120	-11	-12
Eastern Washington	23	23	22	0	-1
Yakima PAC	1	1	1	0	0
Eastern Washington Cascades	4	4	4	0	0
Upper Columbia-Salmon Clearwater RAC R1	12	12	12	0	0
Total	1,118	1,006	993	-112	-125

Abbreviations used in this table:
BLM - Bureau of Land Management
RAC = Resource Advisory Council
PAC = Provincial Advisory Committee
Alt. = Alternative
R1 = Forest Service Northern Region
R4 = Forest Service Intermountain Region

Source: Crone and Haynes 1999.

Table 4- 44. Timber Direct Employment Related to Forest Service- and BLM-administered Lands, by RAC/PAC and Alternative, Average Annual Number of Jobs.

RAC/PAC	S1	S2	S3	S2 Change from S1	S3 Change from S1
Butte RAC	1,247	1,351	1,334	104	87
Klamath PAC	321	395	395	74	74
Deschutes PAC	433	442	457	9	24
John Day-Snake RAC	945	1,473	1,383	528	438
Southeastern Oregon RAC	569	765	694	196	125
Lower Snake River RAC	325	457	497	132	172
Upper Snake River RAC	92	110	109	18	17
Upper Columbia-Salmon Clearwater RAC R4	899	1,124	1,085	225	186
Eastern Washington	377	370	400	-7	23
Yakima PAC	3	8	8	5	5
Eastern Washington Cascades	23	32	40	9	17
Upper Columbia-Salmon Clearwater RAC R1	1,072	1,117	1,199	45	127
Total	6,308	7,644	7,601	1,336	1,293

Abbreviations used in this table:
BLM - Bureau of Land Management
RAC = Resource Advisory Council
PAC = Provincial Advisory Committee
R1 = Forest Service Northern Region
R4 = Forest Service Intermountain Region

Source: Crone and Haynes 1999.

are estimated for the pulp and paper industry. This is not to suggest that there would not be impacts on the pulp and paper industry, only to suggest that the industry will respond to supply-induced changes in ways different from the solid wood products sector.

Forestry Services and Range Restoration-related Employment

Forestry services and range restoration employment opportunities would increase in Alternatives S2 and S3 by about 100 jobs or 40 percent. This information is displayed by RAC/PAC and by alternative in Table 4-45.

Alternatives S2 and S3 would be similar even at the RAC/PAC level. The largest increases in job opportunities would occur in those RAC/PACs where forest stands in need of precommercial thinning are most numerous.

These job numbers should be interpreted with caution. While the job estimates are for full-time equivalent jobs, many of these jobs are seasonal. The implication is that changes would affect more people than the job numbers indicate because the income is being shared among more individuals.

The number of forestry workers required for precommercial thinning was based on a calculation of one job per $43,125 of expenditures. This ratio was then converted to one job per 500 acres treated based on per-acre thinning costs. Range restoration jobs are also based on one job per $43,125 of expenditures.

Prescribed Fire-related and Fuels Treatment Employment

The large increases in prescribed fire activity and associated employment reflect a significant focus of Alternatives S2 and S3 to restore areas to historical fire patterns. Alternative S2 would increase employment by about 2,600 jobs, a seven-fold increase, and Alternative S3 would increase employment by about 1,900 jobs, a five-fold increase. This information is displayed y RAC/PAC and by alternative in Table 4-4

In total, Alternative S2 would provide 700 more jo s than Alternative S3. However, similar to forest y services and range restoration, these job estimates a e for full-time equivalent jobs, while many of the jo s actually are seasonal. The implication is that chang s would affect more people than just the job numbe s indicate because the income is being shared among more individuals.

Table 4-45. Forestry Services and Range Restoration Direct Employment Related to Forest Service- and BLM-Administered Lands, by RAC/PAC and Alternative, Average Annual Number of Jobs.

RAC/PAC	Alt. S1	Alt. S2	Alt. S3	S2 Change from S1	S3 Change from S1
Butte RAC	53	68	67	15	14
Klamath PAC	23	29	29	6	6
Deschutes PAC	26	32	31	6	5
John Day-Snake RAC	44	80	73	36	29
Southeastern Oregon RAC	38	58	51	20	13
Lower Snake River RAC	13	23	23	10	10
Upper Snake River RAC	5	10	10	5	5
Upper Columbia-Salmon Clearwater RAC R4	39	50	49	11	10
Eastern Washington	15	18	19	3	4
Yakima PAC	0	0	0	0	0
Eastern Washington Cascades	1	2	3	1	2
Upper Columbia-Salmon Clearwater RAC R1	35	45	46	10	11
Total	292	415	401	123	109

Abbreviations used in this table:
BLM - Bureau of Land Management
RAC = Resource Advisory Council
PAC = Provincial Advisory Committee
Alt. = Alternative
R1 = Forest Service Northern Region
R4 = Forest Service Intermountain Region

Source: Crone and Haynes 1999.

Table 4-46. Prescribed Fire and Fuels Treatment Direct Employment Related to Forest Service- and BLM-Administered Lands by RAC/PAC and Alternative, Average Annual Number of Jobs.

RAC/PAC	Alt. S1	Alt. S2	Alt. S3	S2 Change from S1	S3 Change from S1
Butte RAC	49	424	402	375	353
Klamath PAC	26	87	74	61	48
Deschutes PAC	49	159	160	110	111
John Day-Snake RAC	93	970	733	877	640
Southeastern Oregon RAC	68	626	364	558	296
Lower Snake River RAC	5	52	21	47	16
Upper Snake River RAC	7	35	37	28	30
Upper Columbia-Salmon Clearwater RAC R4	35	197	170	162	135
Eastern Washington	5	67	53	62	48
Yakima PAC	0	0	0	0	0
Eastern Washington Cascades	2	29	22	27	20
Upper Columbia-Salmon Clearwater RAC R1	23	268	183	245	160
Total	362	2,914	2,219	2,552	1,857

Abbreviations used in this table:
BLM - Bureau of Land Management
RAC = Resource Advisory Council
PAC = Provincial Advisory Committee
Alt. = Alternative
R1 = Forest Service Northern Region
R4 = Forest Service Intermountain Region

Source: Crone and Haynes 1999.

The number of jobs required for the fuel treatment and prescribed fire is similar to forestry workers and was based on a calculation of one job per $43,125 of expenditures. This ratio is also converted to one job per 500 acres.

Effects on Communities

Background

Economic effects of the alternatives on communities would not be substantial when measured against the project area-wide regional economy. The regional economy is strong, growing, and mostly immune from changes proposed in either of the two action alternatives. Science findings noted "...for most people in the basin, expansion in other sectors means that the impact of FS/BLM decisions on their employment and income will be negligible..." (Haynes and Horne 1997).

This may not be true for local areas, especially small rural and tribal communities that are geographically isolated from population centers and are not experiencing the economic growth that characterizes the project area as a whole. This is also not true for economic sectors or individual firms that are economically specialized in industries that depend primarily on federal land outputs, such as wood products manufacturing or ranching. While the influence of these sectors on the regional economy is lessened by the rapid growth in other sectors, changes in federal land uses are still important to those communities and businesses economically (and culturally) tied to these industries.

As discussed in Chapter 2, the effects of implementing the alternatives were estimated at a broad-scale level for RAC/PAC areas. A focus on these larger subregions misses many of the economic concerns associated with Forest Service and BLM land management, which are more local than regional. Where concerns are local, they are as much social issues as they are economic ones.

In the Draft EISs, community resiliency was described as a function of population size, economic diversity, attractiveness, amenities, leadership, and the community residents' ability to work together and be proactive toward change. In Chapter 2 of this Supplemental Draft EIS, additional information by SAG was described, which built on previous studies of community resiliency, but which narrowed the focus to population density, economic diversity, and lifestyle diversity as the three most important, and measurable, factors by which socio-economic resiliency could be assessed. Socio-economic resiliency ratings were developed for all the counties within the project area (Horne and Haynes 1999).

In general, Forest Service and BLM land use decisions have little influence on factors important to socio-economic resiliency. The agencies also have no mandate to set goals for changing community resiliency; however, the Forest Service and BLM can have a role in helping communities achieve their economic goals, which may include economic diversification. Alternatives S2 and S3 include management direction for this purpose.

Socio-economic resiliency is a measure of how well counties or communities may respond to external forces and changes. As such, socio-economic resiliency itself will not change, at least in the short term, in response to changes in federal land management policies and practices. Rather, the measures are used to indicate the degree to which communities may be able to respond to and manage change brought on by external forces or actions, such as those being discussed in this Supplemental Draft EIS.

Potential Effects on Agriculture (Grazing) Specialized Communities

Background

There are 259 identified communities in the project area that have an economic specialization in agriculture (see Appendix 7, Tables 5 and 6). Eighty-six of these communities have been classified as isolated (including isolated trade-centers), and the remaining 175 are considered not isolated. Of the isolated communities, 6 are identified as associated with an American Indian reservation. The agriculture industry includes both crop and livestock production. Many of the communities have strong grazing components, with some linked to federal land grazing permits. It is important to identify this component of agriculture-specialized towns, since the dependency of the livestock industry on BLM and Forest Service forage averages seven percent of the total forage in the ICBEMP project area (Haynes and Horne 1997).

Livestock forage obtained from federal lands was estimated at the county level (Frewing-Runyon 1995). This information is used to identify the 249 (83 isolated) agriculture-specialized towns that are likely to have a significant association with federal land forage. Since the data were collected at the county level, some

Major Changes from the Draft EISs

In the Scientific Assessment (Haynes and Horne 1997), it was estimated that, as of 1990, approximately 220,000 jobs in the basin were associated with livestock grazing, recreation, and timber harvest on lands administered by the Forest Service or BLM. Of those, it was estimated that about 190,000 were associated with recreation. In response to comments on the original methodology, and with further review and analysis, the estimate of recreation-associated jobs was adjusted to about 77,000 as of 1994 (Crone and Haynes in press). The total estimate of jobs associated with livestock grazing, recreation, and timber harvest (accounting for some declines in grazing and timber jobs in the first part of the decade) was reduced to 95,000 (Crone and Haynes 1999).

of these communities may not actually have ties to federal land grazing.

Effects on Grazing Activities by Alternative and RAC/PAC

Federal forage availability and differences among the alternatives during the first decade are displayed in Table 4-34, earlier in this section. As has been discussed, an indirect consequence of actions taken to achieve the desired outcomes of Alternatives S2 and S3 could be a decrease in grazing on Forest Service- and BLM-administered lands of 10 percent for Alternative S2 and 11 percent for Alternative S3 compared to Alternative S1 across the project area. This is less than a one percent change in livestock forage consumption from all ownerships. Changes in AUMs by RAC/PAC were described earlier in the Outputs and Activities section for Livestock AUMs and are shown in Table 4-34.

Socio-Economic Effects on Agriculture (Grazing) Specialized Communities by Alternative

The following discussion highlights the general socio-economic effects that grazing-specialized communities may experience under each alternative. The effects of the alternatives discussed here apply only to those communities associated with federal land grazing and not to all of the communities in the agriculture specialization group.

Estimates of the livestock animal unit month (AUM) production were made for each of the RAC/PACs. These are displayed in Table 4-34, earlier in this section. These estimates were based on the potential effects of implementing each alternative. Table 4-47 shows a measure of the uncertainty under Alternatives S2 and S3 associated with changes in estimated production levels from Alternative S1.

In several of the RAC/PACs, the action alternatives are expected to result in reductions in AUMs as a consequence of management actions taken to protect or improve ecosystem components and achieve desired outcomes in rangeland health. Larger predicted decreases are assumed to correlate with greater uncertainty.

Table 4-48 identifies the magnitude of the effect of potential changes in AUMs from Alternative S1 by RAC/PAC on an average grazing-specialized community basis. (The "average" community basis does not imply that there is an "average" community, or that the effects will be distributed evenly among them. Rather, it is used to provide a comparative basis to display differences among the alternatives.) There are also communities not economically specialized in grazing that may incur reductions in grazing.

The ability of isolated communities to deal with change may be less than that found in larger non-isolated communities. The resulting impacts may differ in magnitude and duration for isolated rural and tribal communities where fewer economic options are available and fewer opportunities exist to interact with nearby towns and cities. Isolated and economically specialized rural and tribal communities located in counties that have higher socio-economic resiliency will likely tend to manage change better than similar communities located in counties where socio-economic resiliency is low. Isolated rural and tribal communities that are specialized in grazing but have few other local businesses and experience high unemployment rates are likely to have a proportionately more difficult time adjusting to adverse effects from potentially decreasing levels of grazing on federal lands.

Table 4-47. Uncertainty Associated with Projected First-Decade Changes in AUMs,[1] by Resource Advisory Council/Provincial Advisory Committee (RAC/PAC).

RAC/PAC	Uncertainty
Butte RAC	Medium
Klamath PAC	Medium
Deschutes PAC	High
John Day-Snake RAC	High
Southeastern Oregon RAC	High
Lower Snake River RAC	High
Upper Snake River RAC	High
Upper Columbia-Salmon Clearwater RAC R4	High
Eastern Washington	Medium
Yakima PAC	Low
Eastern Washington Cascades	Low
Upper Columbia-Salmon Clearwater RAC R1	Low

Abbreviations used in this table:
AUM = Animal Unit Month
RAC = Resource Advisory Council
PAC = Provincial Advisory Committee
R1 = Forest Service Northern Region
R4 = Forest Service Intermountain Region

[1] See Table 4-34 earlier in this section for numbers of AUMs. Uncertainty in this table refers to uncertainty expected for Alternatives S2 and S3 based on the projected changes in estimated production levels from Alternative S1.

Table 4-48. First Decade Average Annual Change in AUMs per "Average" Grazing-Specialized Community, byResource Advisory Council/Provincial Advisory Committee (RAC/PAC).

	Number of Grazing-Specialized Communities		Potential Changes from Alt. S1 (Average AUMs/Community)	
RAC/PAC	Total	Isolated	Alternative S2	Alternative S3
Butte RAC	16	5	-200	-230
Klamath PAC	4	1	-880	-790
Deschutes PAC	8	3	-2,290	-2,790
John Day-Snake RAC	41	19	-570	-880
Southeastern Oregon RAC	7	4	-9,670	-12,060
Lower Snake River RAC	27	6	-1,280	-1,320
Upper Snake River RAC	52	3	-2,530	-2,400
Upper Columbia-Salmon Clearwater RAC R4	10	10	-2,860	-3,140
Eastern Washington	37	17	-40	-90
Yakima PAC	14	0	-10	-10
Eastern Washington Cascades	7	2	-10	-10
Upper Columbia-Salmon Clearwater RAC R1	26	13	-10	-10

Abbreviations used in this table:
AUM = Animal Unit Month
RAC = Resource Advisory Council
PAC = Provincial Advisory Committee
Alt. = Alternative
R1 = Forest Service Northern Region
R4 = Forest Service Intermountain Region

Source: Derived from Appendix 7, Tables 5 and 6, and Table 4-34 earlier in this section.

Potential Effects on Wood Products Manufacturing (Timber) Specialized Communities

Background

There are 132 identified communities in the project area that have an economic specialization in logging and wood products manufacturing (see Appendix 7). Sixty-four of these communities are classified as geographically isolated, including isolated trade-centers. Of these isolated communities, 6 are identified as associated with an American Indian reservation. The remaining 68 communities are classified as not isolated. Timber harvest and wood products manufacturing have been an important part of the basin's economy since the late 1800s. The timber industry was a primary reason why many towns were established, and why they continue to exist today. The supply of timber is important to wood products industries, and the sale of federal timber provides revenues for county roads and schools under the Payments to States, or 25 Percent Fund Act (Act of May 23, 1908, as amended).

In the past, the timber supply from all ownerships was an important factor in determining how the overall supply in a given area may be affected by changes in supply from one ownership. Increases in the distance that logs can be hauled economically have obscured this consideration. The increased haul distances have reduced differences in log supplies between areas and between ownerships, making predictions about the effect of changes in timber supply on local log users difficult. For the purposes of this analysis, timber supplies from other owners are held constant and local supply differences projected by the alternatives are assumed to affect local mills, even though logs can be, and are, hauled greater distances to day than in the past.

Socio-Economic Effects on Timber Specialized Communities by Alternative

The following discussion highlights the general socio-economic effects that timber-specialized communities may experience under each alternative. Table 4-49 identifies the uncertainty associated with the estimated change in timber supply levels (see Table 4-35, earlier in this section) for Alternatives S2 and S3, based on potential timber sale profitability. Currently, the uses and value of small diameter and salvage trees are limited, and projected increases in marketed volume of these products may result in nonviable timber sales. Therefore, a projected increase in timber supply is assumed to be directly related to increased uncertainty. This uncertainty may be reduced to the extent that marketing of timber sales is improved.

Table 4-50 identifies the potential magnitude of the effect of changes in timber supply (see Table 4-35, earlier in this section) on an average timber-specialized community basis by RAC/PAC. (The "average" community basis does not imply that there is an "average" community, or that the effects will be distributed evenly among these communities. Rather, it is used to provide a comparative basis to display differences between the alternatives.) There are also communities not economically specialized in timber that have wood products industries, and which may also experience increases in timber supplies.

The ability of isolated communities to deal with change may be less than that found in larger non-isolated communities. The resulting impacts may differ in magnitude and duration in isolated rural and tribal communities where fewer economic options are available and fewer opportunities to interact with nearby towns and cities exist. Isolated and economically-specialized communities located in counties that have higher socio-economic resiliency will likely tend to manage change better than similar communities located in counties where socio-economic resiliency is low. In the case of those timber-specialized communities (including isolated rural and tribal communities) which experience no change to moderate increases in timber supply in the first decade, economic and social challenges will be less than if they faced decreases, regardless of socio-economic resiliency.

Potential Effects of Restoration and Prescribed Fire/Fuels Management on Communities

Background

It is estimated that current levels of restoration activity support approximately 290 jobs. As discussed earlier in the Employment section, about 110 to 120 additional jobs (compared to current levels) might be expected from undertaking the forest/woodland and rangeland restoration work envisioned in Alternatives S3 and S2, respectively (Table 4-45, earlier in this section).

Table 4-49. Uncertainty[1] in Timber Sale Viability Associated with Projected First-Decade Changes in Timber Supply, by Resource Advisory Council/Provincial Advisory Committee (RAC/PAC).

RAC/PAC	Uncertainty
Butte RAC	Medium
Klamath PAC	Medium
Deschutes PAC	Low
John Day-Snake RAC	High
Southeastern Oregon RAC	Medium
Lower Snake River RAC	Medium
Upper Snake River RAC	Low
Upper Columbia-Salmon Clearwater RAC R4	Medium
Eastern Washington	Low
Yakima PAC	Low
Eastern Washington Cascades	Low
Upper Columbia-Salmon Clearwater RAC R1	Medium

Abbreviations used in this table:
RAC = Resource Advisory Council
PAC = Provincial Advisory Committee
R1 = Forest Service Northern Region
R4 = Forest Service Intermountain Region

[1] Uncertainty in this table refers to uncertainty expected for Alternatives S2 and S3 based on the projected changes in estimated production levels from Alternative S1.

Table 4-50. First Decade Average Annual Change in Timber Harvest (mmbf) per "Average" Timber-Specialized Community, byResource Advisory Council/Provincial Advisory Committee (RAC/PAC).

RAC/PAC	Number of Timber-Specialized Communities		Potential Changes from Alt. S1 (Average mmbf per Community)	
	Total	Isolated	Alternative S2	Alternative S3
Butte RAC	17	8	1	1
Klamath PAC	2	1	5	5
Deschutes PAC	5	1	0	1
John Day-Snake RAC	22	14	3	3
Southeastern Oregon RAC	5	5	5	3
Lower Snake River RAC	9	1	2	2
Upper Snake River RAC	14	1	0	0
Upper Columbia-Salmon Clearwater RAC R4	5	5	6	5
Eastern Washington	14	12	0	0
Yakima PAC	8	0	0	0
Eastern Washington Cascades	3	2	0	1
Upper Columbia-Salmon Clearwater RAC R1	28	14	0	1

Abbreviations used in this table:
mmbf = million board feet
RAC = Resource Advisory Council
PAC = Provincial Advisory Committee
Alt. = Alternative
R1 = Forest Service Northern Region
R4 = Forest Service Intermountain Region

Source: Derived from Appendix 7, Tables 5 and 6, and Table 4-35, earlier in this section.

Employment associated with prescribed fire and fuels management in the first decade is estimated to be substantially higher than for other restoration work. Alternative S3 would support about 1,860 additional jobs, and Alternative S2 would support about 2,550 additional jobs, in addition to the 360 jobs currently supported by these activities.

Socio-economic objectives and standards for both Alternatives S2 and S3 require that restoration activity be focused near those rural and tribal communities that are isolated and economically specialized, and which have the greatest need for economic stimulus. This direction relates to locally determined priorities for restoration as well as those set at the broad scale through identification of high restoration priority subbasins. The management direction requires that the Forest Service and BLM, working with state, county, community, tribal and other federal entities, seek a variety of ways to promote participation of the local workforce and local or tribal businesses in the various restoration and fuels management activities. Therefore, those isolated and economically specialized rural and tribal communities that lie within or adjacent to areas that are a restoration priority, including A2 subwatersheds and/or high restoration priority subbasins, could expect to see higher numbers of jobs and associated economic activity within the first few years of plan implementation than similar communities in areas not prioritized for restoration. (A list of high restoration priority subbasins for Alternatives S2 and S3 can be found in Appendix 15. Information on community location by RAC/PAC and by subbasin within a RAC/PAC can be found in Appendix 7.) Somewhat higher levels of job creation and economic activity related to restoration and fuels management work could be expected under Alternative S3 than Alternative S2.

If either Alternative S2 or S3 were selected, there would be a lag time of months, or even a year or two, before these effects would be realized. This lag time would result in part from the need to complete any required Subbasin Review, EAWS, and NEPA analysis for individual projects or groups of projects.

Effects on Fire Suppression Costs

Fire suppression and fire rehabilitation costs would likely show a limited decrease in the short term because of the amount of time and management actions needed to substantially change landscape disturbance patterns. It could take several decades for management-induced changes in fire regimes to be evident apart from normal season-to-season variation in fire weather conditions. Over the long term, noticeable decreases in the acreage of severe wildfire and associated fire suppression and rehabilitation costs should occur as restoration efforts lead to a progressive shift toward less severe fire regimes. Post-wildfire watershed rehabilitation costs are correlated with wildfire suppression costs, as both reflect the size and severity of wildfires.

Ultimately, there is uncertainty in predicting specific long-term changes in severe wildfire acreage and the suppression and rehabilitation cost that could result. Such a prediction would depend on the complex interaction of natural disturbance processes, the intensity and location of restoration actions conducted by the Forest Service and BLM, and the management of private and other public lands in the project area.

Effects on Communities from Delayed Rate of Implementation

Adverse effects on communities, particularly isolated and economically specialized rural and tribal communities, could result if implementation of the selected alternative (other than Alternative S1) were slower than planned. Slow or delayed implementation would postpone the benefits derived from activities.

A slow rate of implementation of timber harvest activities especially could be cause for concern. Slow or delayed initiation of activities, in addition to changes in the timber program experienced since 1990 (see Figure 2-20, in Chapter 2), could pose potential adverse cumulative effects on the wood products industry and counties whose budgets depend on revenues derived from federal timber sales.

Firms and workers in the wood products industry that have persevered through recent declines could be permanently affected by slow initiation of activities for Alternative S2 or S3, both of which show a first decade increase in timber volume available for harvest.

Temporary mill closures and layoffs can become permanent, resulting in a departure of labor and capital from some rural communities. This may be an inevitable cost of a long-term change in management strategy; however, such losses would represent an unintended consequence of the alternatives if they resulted from a short-term delay in implementing a strategy that would otherwise avoid this outcome. Mill closures and job losses can occur even with rapid implementation if new management direction shifts harvest out of a mill's supply area (assuming alternative timber sources are not available). And some mill

closures and job losses will continue through technological and structural changes in the industry that are unrelated to federal land management policies.

Public Participation and Collaboration

Both Alternatives S2 and S3 include several objectives and standards meant to improve the participation of tribes, state and county government, federal agencies, RAC/PACs, and public interest groups in the planning, implementation, and monitoring of Forest Service and BLM land management strategies and activities. Some of these objectives and standards direct the agencies to assist and support local communities, particularly rural and tribal communities that are isolated and economically specialized, to achieve their economic goals. Some refer to improving efficiency in the delivery of goods and services from Forest Service- and BLM-administered lands, in the context of promoting and supporting commercial and economic activity.

Most of these objectives could probably be achieved through current management direction (Alternative S1). However, incorporating additional direction in Alternatives S2 and S3 is expected to improve the agencies' effectiveness at public participation and responsiveness to public needs. The objectives by themselves would not change people's values, but they should increase understanding among the competing interests and improve public involvement in and acceptance of management strategies, so that plans can be implemented with more consistency and predictability.

Effects of the Alternatives on Environmental Justice

Executive Order 12898 (59 Fed. Reg. 7629, 1994) directs federal agencies to identify and address, as appropriate, any disproportionately high and adverse human health or environmental effects on minority populations and low-income populations.

Implementation of the selected alternative may potentially incur some of these effects. Should these effects occur, they would most likely be related to potential declines in grazing-related jobs and to changes in road access to areas where special forest products are gathered, particular recreation sites, or special places. These effects could occur if a particular minority or low-income population were involved in one of the types of activities mentioned, and if that population were adversely affected to a greater degree than the corresponding majority (Euroamerican) population.

At the broad scale of this analysis, it is not possible to identify specific effects on local populations, from two standpoints. First, the analysis does not identify site-specific output and activity levels. Effects are not projected for areas smaller than a RAC/PAC area. Therefore, at this scale, it is not possible to identify where changes in grazing jobs may occur at the local level, or where road access changes may take place. Second, a "population" will generally be defined at a local or subregional level (although there may be some exceptions to this). Again, because effects are not projected down to the local level in this analysis, it is not possible to identify specific populations that might be adversely and disproportionately affected.

It is more appropriate to evaluate environmental justice effects during the step-down process. At that finer scale, road access and changes in the road system will be evaluated on a local subregional scale, and more specific effects of applying new rangeland management standards will be assessed at that scale, for example. At the same time, areas of special forest products, recreation use, and special places will be identified, and use by local minority and low-income populations evaluated. Management direction found in Chapter 3 requires identification of potential issues related to environmental justice concerns through Subbasin Review and Ecosystem Analysis at the Watershed Scale (EAWS). Full environmental justice evaluations will be done during subsequent plan adjustment or project-level NEPA analysis.

Major Changes from the Draft EISs

In the Draft EISs, community resiliency was described as a function of population size, economic diversity, attractiveness, amenities, leadership, and the community residents' ability to work together and be proactive toward change. In this Supplemental Draft EIS, additional information by SAG was described, which narrowed the focus to population density, economic diversity, and lifestyle diversity. Socio-economic resiliency ratings were developed for all the counties within the project area.

Cumulative Effects

A basic component of the Interior Columbia Basin Ecosystem Management Project identified in Chapter 1 is to support the economic and/or social needs of people, cultures, and communities through the availability of sustainable and predictable levels of products and services from Forest Service- and BLM-administered lands. This includes the need to contribute to the vitality and resiliency of human communities, consistent with maintaining healthy and diverse ecosystems. The expected outputs and services, and their effects on employment and communities, have been discussed in the preceding sections. This section brings together key components of previous discussions to identify cumulative effects.

Socio-economic Resiliency

Chapter 2 introduced an operational definition for socio-economic resiliency developed at the county level for the interior Columbia Basin (Horne and Haynes 1999). The definition provides a socio-economic resiliency index calculated using a composite of three measures: economic resiliency (defined as diversity of employment), population density (defined as people per square mile), and lifestyle diversity (computed using the PRIZM database [Claritas Corporation 1994]). The index resulted in a low, medium, or high rating for each county in the basin. There is no good or bad connotation to the rating; it is simply one way to identify the potential capability of human communities and economies to adapt to change. A community with low employment diversity, low cultural diversity, and low population density will generally be less resilient in adapting to change compared to communities with opposite characteristics. A community or economy that is less resilient will be at more risk when confronting change.

This analysis takes the county socio-economic resiliency indices, displayed in Appendix 7, and aggregates them by RAC/PAC in Table 4-51 for comparison with the alternative effects identified by RAC/PAC in previous discussions.

The RAC/PAC resiliency scores were derived by summing the county indices and dividing by the number of counties in each RAC/PAC. Counties that are split by RAC/PAC boundaries are counted in each RAC/PAC where they are found. The results are then interpreted by identifying RAC/PACs with resiliency scores below two as being less resilient than RAC/PACs with scores that are two and greater. The alternative effects on employment, population density, or lifestyle diversity are then compared to RAC/PAC socio-economic resiliency scores to indicate their relative adaptability.

At the basin or RAC/PAC scale, the alternatives would not have a measurable effect on population

Table 4-51. Cumulative Effects of the Alternatives on Socio-economic Resilience Ratings, by Resource Advisory Council/Provincial Advisory Committee (RAC/PAC) and Alternative.

RAC/PAC	Resiliency Score[1]	Change in Employment S2	Change in Employment S3	Change in AUMs S2	Change in AUMs S3	Change in Timber (mmbf) S2	Change in Timber (mmbf) S3	Change in Prescribed Fire - Fuels Mgmt (Acres) S2	Change in Prescribed Fire - Fuels Mgmt (Acres) S3
Butte RAC	1.8	490	460	-3,300	-3,700	13	11	187,400	176,500
Klamath PAC	3.0	140	120	-3,500	-3,100	10	10	30,200	24,100
Deschutes PAC	2.2	120	130	-18,300	-22,300	1	3	55,100	55,900
John Day-Snake RAC	1.8	1430	1090	-23,300	-35,900	68	57	438,400	320,100
Southeastern Oregon RAC	1.0	750	410	-67,700	-84,400	26	17	279,100	148,200
Lower Snake River RAC	1.7	180	190	-34,500	-35,700	17	22	23,500	8,100
Upper Snake River RAC	1.7	0	10	-131,300	-124,900	2	2	13,800	15,100
Upper Columbia-Salmon Clearwater RAC R4	1.0	380	310	-28,600	-31,400	29	24	81,000	67,100
Eastern Washington	1.9	60	70	-1,200	-3,300	-1	3	30,900	23,900
Yakima PAC	2.5	10	10	-100	0	1	1	100	0
Eastern Washington Cascades	2.0	40	40	-100	-100	1	2	13,500	10,000
Upper Columbia-Salmon Clearwater RAC R1	1.6	300	300	-300	-300	6	17	122,500	79,700

1 = Low, 2 = Medium, 3 = High

[1] Estimated from county level data identified in Horne and Haynes 1999.

density, so this resiliency component is considered unaffected. A change in lifestyle diversity is likely to be affected by the changes in outputs, services, and uses of BLM- and Forest Service-administered lands. The outputs, services, and uses most affected by the alternatives are: changes in livestock grazing, changes in timber harvest and wood products manufacturing, and changes in additional opportunities to maintain lifestyles associated with working in the woods and on rangelands. Prescribed fire and fuels management acres are used in this analysis as an index of all restoration activity since they are by far the largest component.

Change in employment is also an important factor affecting socio-economic resiliency. Although a change in jobs associated with one industry may have minimal effect on employment diversity, it is assumed that decreases in employment will have negative effects on employment diversity and that increases in jobs will have a positive effect.

The implementation of PACFISH, INFISH, Eastside screens, and Healthy Rangelands has resulted in significant declines in extractive resource uses, especially in the amount of timber harvest. BLM and Forest Service goals to restore, maintain, and improve ecosystem health have also altered the size class and species mix of harvested trees. Implementation of Healthy Rangelands direction on BLM lands has increased the emphasis on aquatic and riparian values, altering management of rangelands and livestock utilization. These changes, represented by Alternative S1, have resulted in impacts on the employment and lifestyle diversity components of socio-economic resiliency.

Alternatives S2 and S3 are designed to manage the risk to human social and economic systems as well as the biophysical components of the ecosystem. Rangeland ecosystem management objectives in these two alternatives would result in AUM declines across all of the RAC/PACs. At the same time, however, ecosystem restoration would result in more timber supply and associated timber-related jobs, and more restoration related employment in those RAC/PACs where the potential for forest ecosystem restoration exists. For example, the greatest declines in AUMs would be found in the Upper Snake River RAC, but there are few opportunities to mitigate lifestyle and employment losses associated with grazing declines with additional restoration associated with forested ecosystems. In the Southeastern Oregon RAC, where AUM declines are the second greatest, there are opportunities to mitigate negative socio-economic effects with increased opportunities in restoration.

Both Alternatives S2 and S3 would result in positive cumulative effects on employment and lifestyle diversity in every RAC/PAC compared to Alternative S1. Furthermore, over 90 percent of the increases in timber and restoration activities occur in RAC/PACs with resiliency scores that are less than two. However, individuals and communities who are highly associated with Forest Service and BLM livestock grazing may be negatively affected. Overall, the emphasis of Alternative S2 to minimize short-term risk to the biophysical ecosystem through more restoration activity during the first decade also addresses short-term socio-economic resiliency concerns more than Alternative S3.

Risk Management

The underlying theme of both Alternatives S2 and S3 is management of risk. This includes risk to physical and biological components of ecosystems as well as risk to human communities. Both alternatives seek to manage and minimize the risk to these systems over the long term through protection of important aquatic, riparian, and terrestrial habitats; an aggressive program of ecosystem restoration; and an emphasis on conducting employment- and income-producing management activities near those communities most in need of economic support and stimulus.

The primary difference in focus between the two action alternatives is the degree to which greater levels of short-term risk are accepted while still managing for the same level of long-term risk management and reduction. Alternative S3 accepts a somewhat higher level of short-term risk to biophysical components of ecosystems through less emphasis on conducting Subbasin Review and Ecosystem Analysis at the Watershed Scale prior to implementation of management activities in the first decade.

Management of risk to communities in the basin from changes in federal land management policies, particularly those rural and tribal communities that are isolated and economically specialized, is emphasized in the social-economic-tribal components of both base-level and restoration management direction for Alternatives S2 and S3. In particular, the objectives, standards, and guidelines in the base-level management direction section, Support Economic and Social Needs of Communities and Cultures, emphasize design and use of sales and services contracts that will promote participation of local community and tribal businesses and work force in management of nearby Forest Service- and BLM-administered lands. The objectives, standards, and guidelines in both the base-

level and restoration management direction sections also emphasize giving highest priority to conducting management activities, such as restoration work, in areas near communities and reservations with the greatest economic need.

The identification of high restoration priority subbasins provided a way to integrate restoration needs and opportunities for a variety of ecosystem components and functions, including aquatic and terrestrial species and habitats, habitat mix, disturbance/succession processes, and human social and economic needs. Identification of these subbasins is a major step toward managing risk to forest and rangeland ecosystems, as well as to human communities, while getting the greatest return for the funds expended.

The emphasis of Alternatives S2 and S3 on risk management and reduction is reflected in the effects of the alternatives, as described earlier in this chapter. At least during the first decade, the two action alternatives would generate mostly neutral to positive results for human social and economic needs that may be affected by agency actions. However, the agencies are limited in the amount of overall risk to biophysical components of ecosystems and to human communities that can be mitigated. Many forces are outside the agencies' control. External forces that may affect social and economic conditions include population changes, industry restructuring, changes in economic supply and demand, lifestyle preferences, and climatic changes. In addition, there are legal and regulatory bounds within which the agencies must operate that may limit the amount and type of economic and social support that can be provided directly from the federal level. To the degree those may be limiting, the objectives, standards, and guidelines of the alternatives direct that the agencies support and cooperate with other economic development efforts led by other federal, state, and local entities.

Quality of Life

Quality of life refers to the satisfaction people feel for the place they live (or may visit) and for the place they occupy as part of that experience. As discussed in Chapter 2, a variety of factors affecting quality of life are important to residents and visitors of the interior Columbia basin. Among these are air quality, water quality, open spaces (both with and without roads), and scenery, along with employment opportunities and availability of amenities. In general, there is a concern for balance between environmental and economic facets affecting quality of life.

The interpretation of quality of life factors differs for each individual depending on his or her personal values, occupation, economic status, and other factors. Many factors— such as community infrastructure, medical, education and commercial services, and crime rates—are not directly influenced by Forest Service and BLM management decisions. However, some may be affected by agency decisions, including water and air quality, open spaces, roadless/unroaded lands, scenery, and, to some degree, employment opportunities.

There is no one comprehensive way to measure how the alternatives may affect the quality of life of project area residents. Many other variables that make up one's sense of quality of life are not under the control of the BLM or Forest Service. These factors may be affected by local, regional, national, or global forces. They may change within the basin from year to year or from decade to decade, at regional or local levels, regardless of federal land management decisions. One's perception of whether quality of life is good or bad, better or worse, also is a very personal issue. Two people living under very similar circumstances may have widely varying perceptions about their quality of life. Furthermore, changes in the surrounding economic, social, or natural environment please one person may well displease another.

As with most change, some people would receive a disproportionate share of the benefits while others would bear a disproportionate share of the costs. Accordingly, some may feel their quality of life would improve while others may feel a decline. Rather than measuring how quality of life may be changing, this analysis identifies how the Forest Service and BLM may affect several components used in describing the quality of life.

With their focus on restoration of ecosystem function and healthy habitats, Alternatives S2 and S3 both are expected to have more positive effects on air quality and water quality than Alternative S1. Restoration of aquatic systems and riparian areas should provide improvements in water quality, at least in areas within or just downstream from agency lands. Reduction of forest fuels buildups and restoration of more fire-resistant vegetation structures should lead to long-term improvements in air quality as incidence of large and intense wildfires declines.

Although there will be a much larger amount of prescribed fire in the first decade under Alternatives S2 and S3, compared with Alternative S1, the smoke generated will be spread over the entire burning season (spring through fall), and is not projected to cause health risks or create long-term or large-scale visibility problems. In contrast, smoke generated by large wildfires is typically much more dense, more of a potential health risk, and can cause large-scale visibility problems over wide areas for days, or even several weeks at a time. The increase over the first decade or two in smoke levels from prescribed fire, spread out over the entire burning season, is a near-term tradeoff for a longer-term reduction in the risk of large-scale uncharacteristic wildlife and the associated major air quality impacts.

None of the alternatives is expected to adversely affect open spaces in the basin. Alternatives S2 and S3 over the longer term will contribute more to open spaces that are undisturbed by motorized vehicle traffic, as well as preservation of currently unroaded lands, because fewer roads would be built and some roads would be closed and decommissioned in order to reduce road network densities.

In the short term there would be little difference in effects on scenery among the alternatives. Over the longer term, Alternatives S2 and S3 would be expected to have more positive effects on scenery and scenic quality than Alternative S1, because occurrence of uncharacteristic wildlife would be reduced, riparian areas would be restored, and some vegetation types such as ponderosa pine would be returned to a more characteristic open park-like state.

As displayed earlier in the discussion of effects of the alternatives on employment, at the basin and RAC/PAC levels, adoption of either Alternative S2 or Alternative S3 would result in an overall increase in the employment opportunities in the first decade. Positive effects on employment would occur in the lumber and wood products sector from the commercial utilization of wood volume harvested as part of ecosystem restoration activities, as well as from the actual work undertaken for forest and rangeland restoration and for prescribed fire/fuels reduction. These positive effects would offset projected declines in grazing-related employment at the basin and RAC/PAC levels.

Employment effects basin-wide and at the RAC/PAC scale may mask more locally significant changes that would occur at the county or community level. Changes that affect employment opportunities, either positively or negatively, disproportionately more at the local level than at the basin level may contribute to a more discernable change in quality of life at the local scale than is evident over the broader region.

While there may be local quality of life effects that are more pronounced, or that run counter to, the effects at the basin or RAC/PAC scale, it is not possible to identify those potential finer-scale variations from this broad-scale analysis. However, such variations should become more apparent from the mid-scale and fine-scale analyses to be conducted as part of the step-down process.

In summary, as described above, agency decisions may affect some variables that define an individual's or group's quality of life. However, it is not possible predict actual changes in quality of life at various scales within the basin over the next decade or two based on adoption of any of the alternatives.

Sense of Place

"Sense of place" refers to how individuals or groups define and relate to specific geographic locations. These may be specific natural features; areas such as a particular plain, watershed or park; or a community. A key component of residents sense of place in the basin is living near public lands.

At the broad scale of this Supplemental Draft EIS, it is not possible to identify effects of proposed agency land management decisions on particular places. However, this is an important consideration for potential effects on one of the quality of life factors, for tribes, and for possible environmental justice effects. Therefore, potential effects on sense of place will be further analyzed and considered through mid-scale and fine-scale analyses during the step-down process.

Socio-economic Tradeoffs

Ecosystem management and restoration is a long-term process. For some ecosystem components, such as recovery of riparian areas, aquatic habitat, and anadromous fish populations, it may take 20 to 50 years to bring about substantial change over broad landscapes. While management direction and pro-

jected effects are based on the best available science, there is still a fairly wide band of uncertainty around just what the actual state of an ecosystem will be 50 to 100 years from now.

Management actions taken to prevent further degradation of ecosystems, or to restore ecosystems already in a degraded state, often require a substantial shift in land management policies and practices. In the case of the interior Columbia River basin, this shift began with the implementation of the Eastside screens, PACFISH, INFISH, and Healthy Rangeland strategies.

A shift in land management policies and associated activities to accomplish long-range ecosystem objectives may result in relatively immediate changes to human economic and social patterns. Projections of these shorter term social and economic changes will generally have a higher degree of certainty than projections of ecosystem changes 50 years or more into the future. It is therefore important to identify any short-term social and economic changes, or tradeoffs, that will take place in order to achieve longer-term ecosystem objectives.

As discussed earlier in this chapter, the expected short-term socio-economic effects from implementing either Alternative S2 or Alternative S3, when compared to Alternative S1, are minor but positive in the first decade at the basin scale. The exception is a relatively small projected decrease in grazing AUMs and associated employment. At the RAC/PAC level, short-term effects are expected to be proportionally more positive for several RAC/PACs, and minor but still positive for others. Thus, the implementation of either action alternative to achieve positive long-term ecosystem results is also expected to result in positive near-term socio-economic gains as well, rather than (negative) tradeoffs.

As has been emphasized throughout this section, more individual county and community differences can be expected, compared to the basin- and RAC/PAC-level results. Those differences will become more apparent at finer scales of analysis during the step-down process than can be determined at this broad scale. Where more localized tradeoffs are identified, the objectives, standards, and guidelines of the ICBEMP EIS and implementing Record of Decision are designed to mitigate those effects to the greatest degree possible, and to provide additional assistance and support to communities with economic need.

Federal Trust Responsibility and Tribal Rights and Interests

Methodology: How Effects on Tribal Rights and Interests Were Estimated

Background

Identification of criteria for assessing potential effects of proposed ICBEMP management strategies evolved over a several year period, beginning with staff-to-staff and government-to- government meetings and other information sources. In assessing the Draft EIS alternatives, a socio-cultural evaluation of the alternatives was conducted in part by a panel of representatives of affected American Indian tribes. The methods adopted by the panel to assess effects on American Indian tribes were primarily qualitative, based on selected key indicator variables emphasizing topical areas on which tribal issues appeared to focus. Early project efforts are described in Chapter 4 of the Draft EISs and in Burchfield, Allen, and McCool (1997).

Several key developments occurred since the tribal panels convened. In December 1997, Secretary of the Interior Bruce Babbitt met with representatives of the tribes potentially affected by the ICBEMP management decisions. As a result, a Tribal/ESC (ICBEMP Executive Steering Committee) Working Group was initiated to work on incorporating tribal rights and interests into the integrated project land management strategies. In addition, three Regional Tribal Summits were held, and project executives and staff have continued an ongoing dialogue with tribal governments and staff, further refining what are essentially evaluation criteria.

Commonly at issue was how management direction has progressed or changed since the Draft EIS. New studies of tribal communities in the region also appeared, including Economic Contributions of Indian Tribes to the Economy of Washington State (Tiller and Chase 1998). New formal guidance addressing government-to-government relations has appeared as well, including the 1996 Executive Order 13007 addressing protection of sacred sites, the 1997 Secretarial Order 3206 addressing tribal rights and the Endangered Species Act, and Executive Order 13084 of May 14, 1998, addressing consultation and coordination with Indian tribal governments regarding development of federal policies.

Broad-scale Evaluation Methods for Consideration of Tribal Rights and Interests, Habitat Trends, and Harvestability

American Indian tribes and tribal communities depend on Forest Service- and BLM-administered lands for economic, cultural, subsistence, religious, and treaty purposes. The culture as well as the rights and interests of American Indian people are rooted in these lands, and tribal teachings are based on understanding the relationship between themselves, as a people, and the land and its resources. While at the broad scale these values cannot be quantified or measured in a scientific sense, the following evaluation methods are possible:

a. The ability of alternatives to protect and/or restore habitat for species associated with the rights and interests of tribes can be evaluated and the habitat trend predicted;
b. Alternatives can be evaluated on their relative influence on aiding ecological processes such as natural disturbance regimes and proper functioning condition, upon which tribal rights and interests depend;

c. Alternatives' responsiveness to tribal social/ economic needs and considerations can be considered; and

d. The responsiveness of alternatives to providing for consistent and substantive tribal consultation and involvement can be estimated. This is important because protection and/or restoration of habitat important to the rights and interests of tribes is predicated upon substantive consultation with tribal governments.

Accordingly, management direction was evaluated several ways for each alternative:

1. The Science Advisory Group (SAG) assessed potential effects of Supplemental Draft EIS alternatives on tribal rights and interests using three primary criteria categories: Politico-legal Relations, Ethno-habitat Management, and Socio-Economics. These categories represent an artifical collapsing of the eight basin-wide tribal issues that management direction is intended to address (see sidebar on basin-wide tribal issues).
2. Implementation of management direction was modeled by the SAG where possible. For example, selected species (plant, animal, fish/ aquatic) generally important to the rights and interests of American Indian tribes were associated with vegetative cover types and structural stages, as well as with source habitat for the 12 Terrestrial Families and with the habitats for key salmonids, where appropriate. Habitat and species trends were then predicted based upon these findings.
3. Trends (historical, current, projected future) in habitat status or population outcomes were used to measure the habitat's capability to provide harvestable populations of resources associated with tribal rights and/or interests.
4. Where effects couldn't be modeled (such as much of the process direction for consultation, monitoring, and step-down analysis), evaluation was qualitative and based on whether or not the alternative contained direction which appeared to be responsive to basin-wide tribal concerns.
5. Selection of subbasins for active restoration actions was considered critical for assessing the relative effects of the alternatives on tribal interests. Subbasins in the region were identified as high priority based, in part, on tribal interests (offering the highest need or most opportunity for the restoration of resources important to tribes in addition to enhancing employment and economic development opportunities).

Rationale for Qualitative Interpretations of Modeling of Management Alternatives

While the Science Advisory Group (SAG) measured effects using various predictive models, many times these methodologies were unable to incorporate and measure the effects of implementing direction on tribal rights and interests, which may differ significantly from non-tribal implications.

For example, social-economic considerations for tribes include tribal subsistence, cultural, or treaty uses. Where SAG models or analysis processes were unable to fully display the effects of management direction, socio-economic findings were qualitatively adjusted. Typical social/economic indicators, such as the ones used to characterize specialized communities in the interior Columbia Basin, do not readily lend themselves to characterization of reservation communities. For example, "industry specialization" presupposes that there is industry present which can be categorized and compared relative to other communities across the project area. It also presupposes that the value of federal lands and resources is primarily associated with the commodity products they provide relative to these industries. This generally is not the case for American Indian tribes and tribal communities, although some elements may have application for tribal communities. Where applicable, these were emphasized in the social-economic analysis; where they were not applicable, alternatives were evaluated on how well management direction responded to tribal basin-wide issue of employment and economics, as well as the protection and/or restoration resources on lands administered by the Forest Service and BLM, which are critical to reservation communities and the American Indian people who live there.

Two factors were important for an assessment of ethno-habitat management effects: (1) health and abundance of ethno-habitats (as indicated by relative protection and/or restoration direction, and habitat trends for harvestability), and (2) American Indian access to ethno-habitats for harvest. Consequently, to provide a relative ranking of effects on resources associated with contemporary Indian interests, a qualitative assessment was made as to how alternatives: (a) would provide for consideration of the exercise of tribal reserved rights as provided by

Basin-wide Tribal Issues

Language in quotations is from Tribal/ESC Working Group material provided by tribal representatives. Other language is summarized or paraphrased by ICBEMP. NOTE: Since the issues influence and are interdependent in their relationship to one another, there is much overlap between these major areas. Furthermore, the eight issues, while raised and defined by tribal representatives in a working group and discussed in numerous other forums between tribal and agency leadership, should be understood to be an artificial collapsing of project-area-wide tribal issues and concerns. Any particular tribe, as an individual sovereign, may have offered a significantly different mix of issues as their own.

1. Treaty/Federal Trust Responsibility: "The federal government and the tribes must develop a common understanding of the federal government's trust responsibility. This includes land management designed to protect resources reserved by treaties or executive orders. It is likely that we (tribes) would have to identify those resources."
2. Harvestability as Soon as Possible (ASAP): Harvestability refers to the availability of sufficient habitat for adequate numbers of aquatic, animal, and plant species for harvest by tribes as a part of their culture and for the meaningful exercise of reserved rights. ASAP is in reference to those species (particularly salmon) currently at risk and the tribal desire for federal management of habitat to aid species progression from viability to recovery and harvestability in the shortest possible time frame by managing or avoiding further risk to these at-risk species and their habitat.
3. Basin-wide Habitat Standards: "The tribes and the federal government must agree on a set of binding basin-wide objectives for anadromous fish, freshwater fish, wildlife, and plant species that will ensure restoration of these resources."
4. Interagency and Intergovernmental Coordination/Collaboration: "The federal government's land management decision-making will affect Columbia Basin fish and wildlife restoration efforts. Federal land management must be thoroughly coordinated... and these decisions must be consistent with federal trust responsibilities and Indian treaty rights."
5. Monitoring and Accountability: "The federal government must commit to monitoring and accountability protocols."
6. Government-to-government Collaboration/Consultation: "The Tribes and the Federal government need to develop a streamlined, meaningful, and feasible consultation process that results in a resolution of the issues."
7. Implementation Funding: "There is very little likelihood that Congress will fully fund ICBEMP (nor will) the regulatory agencies (EPA, NMFS, and the USFWS) receive the funds needed to implement their obligations under the existing ICBEMP fish habitat and water quality management approach. (Save) the expense of analysis... by implementing simple riparian prescriptions." If not fully funded, don't selectively scale back portions of the decision, such as monitoring, but all aspects of the decision.
8. Tribal Economics and Unemployment: Tribes depend on Forest Service- and BLM-administered lands for economic, as well as cultural, subsistence, religious, and treaty purposes. ICBEMP should strive to provide employment or contracting opportunities in which tribes can participate and aid in tribal community well-being as well as the recovery of the land and resources.

treaty or executive order; (b) would provide for consideration of tribal access to healthy ethno-habitats in traditional use areas as provided by federal statute; and, (3) would protect and/or restore resources and species important to tribes as well as landscape processes.

Variation among the three Supplemental Draft EIS alternatives regarding monitoring and accountability was determined to be insignificant for evaluation purposes; however, this was qualitatively adjusted for the following reasons: While Alternatives S2 and S3 would be equally responsive, Alternative S1 would rate lower since no basin-wide monitoring strategy is required under this alternative, and there is no multi-scaled analysis process to aid monitoring and adaptive management efforts, which are defined as inclusive of tribal participation.

Effects of the Alternatives on Federal Trust Responsibility and Tribal Rights and Interests

Assessment of effects on federal trust responsibility and tribal rights and interests is difficult at the broad-scale level. Because of various factors including distinctness of communities, their spatial discreteness, and the sensitivity of resource and economic information, assessments should more appropriately be performed at finer scale levels in coordination with the tribes. However, some trends can be identified and are summarized here. Discussions are arranged by the categories used by the Science Advisory Group (SAG) in their assessment of potential effects of the Supplemental Draft EIS alternatives on tribal rights and interests (Hanes 1999):

- Politico-legal Relations,
- Ethno-habitat Management, and
- Socio-Economics.

These categories represent an artifical collapsing of the eight basin-wide tribal issues that management direction is intended to address (see sidebar on basin-wide tribal issues).

Politico-legal Relations

Politico-legal relations stresses the unique relationship between the federal government and tribal governments that is distinct from social communities found in the region. Included in this category are Treaty and Federal Trust Responsibility, Intergovernmental Coordination and Collaboration, and Federal Monitoring and Accountability criteria.

Key factors influencing the qualitative rankings of alternatives for politico-legal relations was the relative degree that alternatives would provide for consistency in interagency, region-wide consultation policies and guidelines, and the relative opportunities for tribal government access to and involvement in agency planning and decision-making.

Overall, Alternative S2 for long-term benefits, and Alternative S3 for short-term benefits, would likely bring about enhanced agency–tribe relations through more effective approaches in communication and an emphasis on a balance of agency policy, program, and project level participation of tribes.

Table 4-52 shows a relative ranking of 1, 2, or 3 to indicate a range from most to least, respectively, of how responsive management direction is to four primary issue areas of tribal-BLM/Forest Service relations, based on qualitative information and the description of the alternative.

Treaty/Federal Trust Responsibility

All three Supplemental Draft EIS alternatives reflect the management intent to be responsive, as land management agencies, to the federal trust responsibility and the rights and interests of affected federally-recognized tribes. However, Alternative S2 appears to be most responsive to honoring the federal trust responsibility and consideration of tribal rights and interests (Table 4-52), because it best responds to several critical tribal issues:

- While Alternative S1 may retain greater riparian and aquatic prescriptive language, in some cases, than Alternatives S2 and S3, it does not have the basin-wide integrated restoration strategy which would provide not only for aquatic needs but also terrestrial, landscape, and social considerations. Alternative S1 also lacks a basin-wide monitoring strategy.
- While both Alternatives S2 and S3 have basin-wide direction for the protection and restoration of habitat, Alternative S2 would provide more upfront direction (processes and prescriptions) than Alternative S3, and therefore higher certainty to tribes of consistent and accountable implementation.
- Alternative S2 also would provide the highest levels of habitat protection for habitats of species most at risk than either Alternative S3 or Alternative S1. Alternative S1 has no management direction aimed at protection and/or restoration of key habitats and species in A1, A2, or T areas. Alternative S3 has the same protection and restoration for T areas as Alternative S2, but less area in A1 and A2 subwatersheds.
- Because of the increased requirements for multi-scaled analysis, there would be greater predictability in Alternative S2 than in Alternative S3 or Alternative S1, that risk will be managed conservatively and restoration will be focused where it most needs to occur.

Table 4-52. Relative Effects of the Alternatives on Politico-legal Relations.

Issue Area	Alternative S1	Alternative S2	Alternative S3
Treaty/trust responsibility[1]	3	1	2
Federal intergovernmental coordination[2]	3	1	1
Tribal consultation[3]	3	1	2
Federal monitoring and accountability[4]	3	1	2
Politico-legal relations overall	3	1	2

1 = Management direction most responsive to tribal basin-wide issues on this subject; 3 = least responsive.

[1] To provide a *relative ranking for treaty/trust responsibility*, consideration was given to the relative degree that alternatives are responsive to the eight basin-wide tribal issues. Since no federal land management interpretation exists which definitively denotes respective treaty/trust responsibilities, federal managers have strived to honor treaty and trust responsibilities by being as responsive as possible to tribal issues and concerns regardless of whether it was done as a legal trust obligation or a matter of policy. Relative ranking is also based upon how well alternatives would provide for protection and restoration of treaty resources and other resources important to the rights and interests of tribes.

[2] To provide a *relative ranking of federal intergovernmental coordination*, a qualitative assessment was made as to how alternatives would provide for interagency and intergovernmental coordination on basin-wide issues involving federal land management. Also examined was how well alternatives provided opportunities for involvement of regulatory agencies in BLM and Forest Service planning and decision making processes.

[3] To provide a *relative ranking of tribal consultation*, a qualitative assessment was made as to how well alternatives would provide opportunities for tribal consultation, as well as define and provide direction for substantive tribal consultation in multi-scaled analysis and decision making processes.

[4] To provide a *relative ranking of federal monitoring and accountability*, a qualitative assessment was made as to the amount and type of management direction provided by alternatives. Alternatives were rated based upon the amount of prescriptive and process direction, as well as the amount of designated T, A1, and A2 areas.

- Alternatives S2 and S3 would be most responsive to the restoration of resources and species significant to potentially affected tribes. Of the 16 high restoration priority subbasins emphasizing restoration for tribal interests, 11 are included in Alternative S2; all 16 are included in Alternative S3, and none are identified in Alternative S1. While Alternative S3 may appear to be more responsive to restoration because it includes more subbasins with a tribal emphasis, has less emphasis on analysis, and has more on projects, actually Alternative S2 appears to be the better performer. This is mainly because Alternative S2 would have more restoration activities spread over fewer subbasins, so the rate and intensity of restoration would be greater for habitats in those subbasins than it would be for Alternative S3, which must cover more ground with less restoration activities.

Intergovernmental Coordination and Collaboration

Generally, Alternatives S2 and S3 would provide the best approach to appropriate government-to-government consultation (Table 4-52).

This is expected given that Alternative S1 would not address the inconsistencies in tribal consultation between agency administrative units or emphasize a more effective consultation process as found in Alternatives S2 and S3. Under existing BLM and Forest Service regional guidance and land use plans (Alternative S1), management actions addressing the government-to-government relationship with tribes have little and varying direction to address the complex federal legal responsibilities toward tribes. When dialogue does occur between agencies and tribes, it typically occurs within the context of agency business and the NEPA process rather than being a government-to-government-driven dialogue process. Agency expectations for tribal responses to their inquiries within specified regulatory time frames, which legally apply only to federal agencies, maintain stress on agency-tribe relations.

Alternatives S2 and S3 would provide direction for more opportunities for tribal involvement in both planning and decision-making processes than would Alternative S1, based on an approach to identify, understand, and work toward resolving conflicts through a relationship characterized by ongoing dialogue between agencies and tribes. As time passes and relations are developed based on effective consultation, and as ethno-habitat trends, access, and

ecosystem conditions are addressed, it is expected that agency–tribal relations will improve. Alternatives S2 and S3 also would enhance the development of tribal self-governance programs and would more effectively support tribal self-determination than would Alternative S1. (However, Alternatives S2 and S3 could also be seen as somewhat limiting opportunities for consultation and access to agency policy-making by providing up-front structure to management decisions through identification of high priority restoration subbasins, as well as A1, A2, and T areas.)

Some differences do exist between Alternatives S2 and S3. For instance, with more restoration subbasins potentially located near tribal lands in Alternatives S3 than Alternative S2, opportunities for collaboration at the project level may be heightened in Alternative S3 at least for short-term beneficial results; however, there is more certainty and accountability under Alternative S2 because of increased multi-scaled analysis requirements aiding the focus of restoration and protection.

Alternative S2, with more extensive requirements for analysis at finer scales, would provide increased opportunities for tribal involvement in planning processes over Alternative S3. Alternatives S2 and S3 also would provide for a more tiered contribution from tribes in agency planning and decision-making processes than would Alternative S1. In other words, requirements for tribal consultation in each analysis process (broad, mid, fine, project) as well as in project decisions provides opportunities for tribes to "nest" responses to their concerns at different scales so that they all contribute to an overall solution rather than focusing at any one scale. Since Alternative S2 has more extensive multi-scaled analysis requirements, it would somewhat outperform Alternative S3 for the long term, and would greatly outperform Alternative S1.

Federal Monitoring and Accountability

Alternatives S2 and S3 would be comparable relative to monitoring and accountability, Alternative S1 would rate lower since no basin-wide monitoring strategy is required under this alternative, and there is no multi-scaled analysis process to aid monitoring and adaptive management efforts, which are defined as inclusive of tribal participation.

Regarding monitoring processes, Alternatives S2 and S3 would offer basin-wide monitoring strategies and multi-scaled analysis while Alternative S1 would not. No broad-scale monitoring strategies, particularly interagency in nature, are currently in place to be carried forward by Alternative S1. Consequently, with greater multi-scaled analysis requirements, Alternative S2 potentially offers the most comprehensive monitoring strategy.

Regarding accountability in basin-wide objectives, the project sought to develop an integrated ecosystem strategy, including "binding" basin-wide objectives and standards which ensure appropriate protection and/or restoration of resources. While the resultant strategy is multi-species and emphasizes aquatic, terrestrial, landscape, and social elements, many of the principles and objectives for management of resources and associated species in the ICBEMP preferred alternative are considered consistent with the Columbia River tribes' salmon restoration plan, Wy-Kan-Ush-Mi Wa-Kish-Wit (Columbia River Intertribal Fish Commission 1995).

Accountability factors also potentially vary by alternative. Although legal responsibilities and requirements are consistent across all alternatives, the emphasis on process in Alternative S2 offers a greater role for step-down processes, monitoring, and tribal collaboration. Collaboration would likely become more consistent across the region under Alternative S2 than Alternative S1 or Alternative S3. Additionally, because of multi-scaled analysis involvement, tribes can "nest" responses to any particular issue at the appropriate scale and better contribute to an overall solution; this is better responded to by Alternative S2 than Alternative S3, and it is not addressed in Alternative S1.

Ethno-habitats are those portions of the natural habitat range of plant and animal species that play a role in sustaining important socio-cultural traditions of tribal communities.

Ethno-habitat Management

Ethno-habitat management criteria invoke a broad range of terrestrial and aquatic resource interests, including water quality and quantity. Ethno-habitat issues involve protection and restoration of resources, harvestability, and access factors.

Ethno-habitats are considered here as those portions of the natural habitat range of plant and animal species (including fish and other aquatic species) that play a role in sustaining important socio-cultural traditions of tribal communities (see Chapter 2).

Given the reliance of tribes on these lands and resources, evaluation of the alternatives considered the protection and/or restoration of terrestrial and aquatic resources, species, and landscape processes, as well as the water that sustains ethno-habitat health.

Two factors were important for this assessment: (1) health and abundance of ethno-habitats (as indicated by relative protection and/or restoration direction, and habitat trends for harvestability), and (2) American Indian access to ethno-habitats for harvest. Consequently, to provide a relative ranking of effects on resources associated with contemporary Indian interests, a qualitative assessment was made as to how alternatives: (a) would provide for consideration of the exercise of tribal reserved rights as provided by treaty or executive order; (b) would provide for consideration of tribal access to healthy ethno-habitats in traditional use areas as provided by federal statute; and, (3) would protect and/or restore resources and species important to tribes as well as landscape processes.

Overall, for long term region-wide results, Alternative S2 would offer the best opportunity of the three alternatives for addressing protection and restoration of ethno-habitats, access, and harvestability considerations as they relate to tribes. Alternative S3 may present more opportunities to address resources and habitats important to tribes in those high priority restoration subbasins near reservations, than would Alternative S2. However, the benefit may be more applicable to the particular tribe(s) associated with the reservation rather than to the ethno-habitats basin-wide. Again, this is because Alternative S3 would have a lower rate and intensity of restorative actions than Alternative S2.

Table 4-53 shows a relative ranking of 1, 2, or 3 to indicate a range from most to least, respectively, of how responsive management direction is to four primary issue areas of ethno-habitat management, based on qualitative information and the description of the alternative.

Important Species and Habitats

American Indian tribal cultural uses in the project area typically have their basis in individual cultural traditions and seasonal subsistence patterns (see Chapter 2), involving acquisition or use of potentially hundreds of species and use of many ethno-habitat types over the course of a year. Traditional uses considered here include Indian peoples' sacred values and uses of the landscape and cultural places. Because of the critical importance of tribal fisheries and their extensive decline in recent years, aquatic species and habitats are particularly important for the ethno-habitat evaluation. Analyses show that all alternatives would improve aquatic habitat condition and population status for the six key salmonids compared to projected current conditions over the long term. Alternative S2 would result in the most improvement followed by Alternative S1 and Alternative S3. Alternative S2 would maintain riparian ecological processes through time based on the RCA delineation criteria. Some uncertainty is associated with the other two alternatives, where one-half site potential tree height is used as an interim RCA delineation criteria. For more detailed discussion on aquatic habitat and riparian effects refer to the Aquatic Effects section of this chapter.

Table 4-53. Relative Effects of the Alternatives on Ethno-habitat Management.

Issue Area	Alternative S1	Alternative S2	Alternative S3
Protection/restoration of important species/habitats/ water	3	1	2
Restoration of landscape processes	3	1	2
Harvestability	3	1	2
Access	3	1	2
Ethno-habitat management, overall	3	1	2

1 = Management direction most responsive to this subjects and basin-wide tribal issues; 3 = least responsive.

The elements in Table 4-53 were rated relative to each alternative using a 1, 2, or 3 to show a range of most to least able, respectively, to respond to tribal issues of harvestability, provide for basin-wide protection and/or restoration of ethno-habitats and resources important to tribal rights and interests, and provide access to these resources and places. Greater emphasis on direction addressing negative road effects was not assumed to equate to negative impacts to tribal access, since management direction requires tribal consultation and involvement in access management decisions. Predicted road closures, however, were assumed to provide greater protection to sacred and cultural resource sites important to tribes. Alternatives with more T, A1, and A2 areas were less responsive to access, but rated higher for resource protection and restoration.

Regarding anadromous fishes, habitat capacity is expected to substantially increase under all alternatives. Overall habitat capacity results indicate that Alternative S2 would result in a stronger trend than Alternative S1. Outcomes for Alternative S3 are consistently lower than the other alternatives. Although habitat capacity would improve under all alternatives, population status outcomes reflect minor or no improvement. This reflects the uncertainty associated with migration corridor survival, especially for populations above several dams in the Snake River and Upper Columbia River. For more detailed discussion on anadromous fish effects refer to the Aquatic Effects section of this chapter.

The SAG did not attempt to model the effects of changes in habitat on narrow endemic and sensitive fishes because the specific environmental requirements of these species are largely unknown. However, SAG did provide trends which are useful for determining which species may experience relatively large or minor changes compared to current conditions. Trends in habitat capacity would be positive under all alternatives. The largest changes in habitat capacity would occur in Alternative S2, followed by Alternative S1. Alternative S3 would not result in the most improvement for any species in this analysis. For more detailed discussion on narrow endemic and sensitive fishes refer to the Aquatic Effects section of this chapter.

Regarding the plant habitat analysis (Croft and Owen 1999), problems of scale are associated with the findings. If one were to look at the basin-wide outcomes associated with some species of interest to tribes, it would appear that all alternatives would result in a continued decline despite habitat gains on federal lands and the increased restoration emphasis of two of the alternatives. This conclusion, however, must be qualified by the fact that many of these plants and their associated habitats tend toward micro-environments rather than broad bands of vegetative communities. Analyses at finer scales may display other results. Probably the most critical finding is that "restoration actions that improve landscape outcomes also improve plant habitats important to tribes;" this then leads to Alternative S2 being most responsive. Further, the analysis also asserts that tribal consultation direction, coupled with step-down analysis requirements regarding resources and lands important to tribes, would further contribute to the protection and/or restoration of plants and plant habitats associated with the rights and interests of tribes. Given the greater requirements for multi-scaled analysis and protection/restoration direction, as well as consultation requirements of Alternative S2, it again appears that Alternative S2 would be more responsive than Alternative S3 or Alternative S1.

The concerns and issues involving water are broad and related to a host of tribal rights, social-economic needs, cultural uses, and property interests. Tribal governments are especially concerned about water quality and quantity, hydrologic functions, aquatic ecosystems' integrity, and soil integrity. Alternative S2 is predicted to have a more positive influence on improving water quality, followed by Alternatives S3 and S1. The restoration emphasis intended to reduce uncharacteristic adverse effects from disturbances indicates that Alternative S2 would maintain or slightly restore hydrologic processes, more so than Alternative S3. The highest benefits to water quality, hydrologic function, and soil productivity are expected to be gained with higher levels of landscape restoration that would occur in the high restoration priority subbasins under Alternative S2. Alternative S3 would provide similar benefits, but in smaller amounts across the project area. Alternative S1 is predicted to maintain hydrologic function at current levels. The maintenance approach in Alternative S1 would not promote restoration of broad-scale landscape processes that influence water quality, hydrologic function, or soil productivity. No decreases in long-term soil productivity would result from implementing any of the alternatives.

Restoration of Landscape Processes

Changes in landscape disturbance processes over the project area are tied closely to changes in vegetation patches, patterns, structure, and composition. Fire was, and continues to be, one of the predominant disturbance process in the project area. In general, Alternative S2 would increase the fire activity (prescribed fire, "wildland fire use for resource benefit", and wildfire combined) in the project area slightly more than Alternative S3, which is sharply higher than Alternative S1. These differences between Alternatives S2 and S3 and Alternative S1 are even more dramatic in the integrated high restoration priority subbasins. Conversely, there is little difference among the alternatives relative to fire activity in A1 subwatersheds and in wilderness.

Effects from uncharacteristic wildfire are expected to increase slightly under Alternative S1 and decrease in Alternatives S2 and S3, with Alternative S2 being slightly better on Forest Service- and BLM-administered lands in the long term. Again, because of the higher emphasis on restoration and greater restoration activity, the differences between Alternatives S2 and S3 and Alternative S1 are more pronounced in the high restoration priority subbasins.

Historical range of variability (HRV) refers to the estimated range in which disturbance regimes, vegetation characteristics, and other ecological

processes and functions fluxed over time. Departure from HRV is another way to gauge the restoration of landscape processes. Basin-wide, on Forest Service- and BLM-administered lands, HRV departure would continue to decline under all alternatives. The highest decline would be under Alternative S1; Alternative S2 would have the least HRV departure, with Alternative S3 in between.

Because disturbance regimes and overall ecosystem health are best addressed in high restoration priority subbasins, the selection of subbasins for active restoration actions is a critical element in achieving landscape health as well as in assessing the relative effects of the alternatives on tribal interests. An analysis was performed by the EIS Team to identify high restoration priority areas based, in part, on tribal interests. Subbasins were identified as very high priority based on offering the greatest need or greatest opportunity for the restoration of resources important to tribes in addition to enhancing employment and social-economic considerations. In Alternative S2, 11 of the 40 high restoration priority subbasins, or 28 percent, were selected on the basis of tribal interest. In Alternative S3, 16 of the 51 high restoration priority subbasins, or 31 percent, were selected on the basis of tribal interest. From this comparison, Alternative S3 could possibly provide higher benefit to tribal communities since more reservations (and therefore tribes) would have at least one basin-wide high restoration priority subbasin near their reservation. However, the benefit may be more applicable to socio-economic considerations than to protection and restoration of the habitats basin-wide. Again, this is because Alternative S3 would have a lower rate and intensity of restorative actions than Alternative S2 overall.

Harvestability

While determination of Supplemental Draft EIS alternative implications for harvestability on a broad scale are not particularly amenable to analysis, Table 4-54 shows predicted species or habitat trends for selected species associated with the rights and interests of tribes. These are discussed in more detail following the table.

Table 4-54. Relative Effects of the Alternatives on Harvestability of Terrestrial Vertebrate Species Important to Tribes.

Selected Tribal Species of Interest	Trend from Current Alternative S1	Trend from Current Alternative S2	Trend from Current Alternative S3
Big game—mule deer, elk, and white-tailed deer	Stable S1=S2=S3	Stable S1=S2=S3	Stable S1=S2=S3
Family 2—blue grouse, northern goshawk, great gray owl, boreal owl, flammulated owl	Improving S2>S3>S1	Improving S2>S3>S1	Improving S2>S3>S1
Family 5—gray wolf, grizzly bear, bighorn sheep, mountain goat, and long-eared owl	Stable S2=S3>S1	Stable S2=S3>S1	Stable S2=S3>S1
Family 10—pronghorn, burrowing owl, short-eared owl, and ferruginous hawk	Stable S2=S3=S1	Stable S2=S3=S1	Stable S2=S3=S1
Family 11—sage grouse and pygmy rabbit	Decline[1] S2=S3>S1	Decline[1] S2=S3>S1	Decline[1] S2=S3>S1
Family 12—sharp-tailed grouse	Decline[1] S2=S3>S1	Decline[1] S2=S3>S1	Decline[1] S2=S3>S1
Riparian-wetland—bald eagle, canada goose, ducks, coots, herons, swans, western screech owl	Improving S2>S3>S1	Improving S2>S3>S1	Improving S2>S3>S1

Species whose outcomes appear secure on Forest Service- and BLM-administered lands: moose, golden eagle, marmot, snowshoe hare, black bear, jackrabbits, Nuttall's cottontail rabbits, spruce grouse, ruffed grouse, merlin, black-tailed deer, Swainson's hawk.

[1] These species would decrease under all alternatives, but Alternatives S2 and S3 would lessen the decline. See Terrestrial Species section of this chapter for additional discussions.

Source: Hemstrom et al. 1999; Rieman et al. 1999.

Terrestrial Wildlife

Twenty-eight terrestrial vertebrates of conservation concern (including pronghorn antelope, bighorn sheep, grizzly bear, grey wolf, sage grouse, and sharp-tailed grouse) that depend on upland environments were assessed for possible response to the Supplemental Draft EIS alternatives (Raphael et al. 1999). The analysis suggests that population densities of terrestrial wildlife would increase on agency lands more than on non-federal lands. This pattern is more apparent in Alternative S2. Analysis of the alternative effects on road densities conclude that Alternatives S2 and S3 would reduce road densities to a somewhat higher degree than Alternative S1.

Specific conclusions include the following. Relative population density for bighorn sheep, pronghorn, American marten, blue grouse, sage grouse, and Columbian sharp-tailed grouse was predicted through models. This adjusted, inherent habitat capability was predicted for Forest Service- and BLM-administered lands within a species range. For bighorn sheep, population density would be slightly up from current levels with all alternatives. Pronghorn are slightly down under all alternatives, American marten and blue grouse would be substantially up under all alternatives, and sage grouse and sharp-tailed grouse would decrease under all alternatives, although Alternatives S2 and S3 may lessen the decline (see Chapter 4 - Terrestrial Vertebrate Species Section).

A second analysis (Lehmkuhl and Kie 1999) on terrestrial species focused on the culturally important "big game" species of elk, mule deer, and white-tailed deer habitat capabilities. Conclusions from this analysis suggest that habitat capability to support elk, mule deer, and white-tailed deer generally would be maintained or modestly increased under all alternatives in the long term (100 years).

A contributing factor that would enhance habitat improvement and greater responsiveness of both Alternatives S2 and S3 is the conservation focus on certain terrestrial source habitats in T watersheds, which would directly benefit culturally important species and substantially supplement the more intensive efforts in high restoration priority subbasins. Improved connectivity among such habitats is a prescribed long-term goal.

Plants

An analysis of the potential effects of the three Supplemental Draft EIS alternatives on the availability of native plants of tribal interest for harvesting indicates that species found "in a broad range of cover types and structural stages" project a future increase in number of plants from historical levels (Croft and Helliwell 1999). The study also concludes that cultural "plants in nonforested habitats are more at risk for decreases in habitat" than forested and riparian/wet meadow habitats.

Assessing cultural plant trends at the broad scale is tenuous because broad-scale vegetation data routinely underestimate existing riparian habitat and poorly represent the highly important scabland (composed of mounds of windblown soil surrounded by rock fragments) ethno-habitats. Consequently, cultural plant trends are best evaluated during project planning at finer scales. However Croft (1999), citing M. Hemstrom, states:

> "Restoration actions that improve landscape outcomes under both alternatives S2 and S3, will most likely improve habitat for tribal plants, as none are considered rare. Alt. S2 would most likely be more beneficial to (these) plants since it has more step down analysis requirements, though S3 does have more acres targeted for active restoration that are strategically located near reservations. Crucial to improvement is that the plants of concern to tribes in the area are considered and restoration activities are planned to benefit/protect these species and their habitat"

Croft further states, "Those species that occur in a wide range of habitat types will be better able to withstand disturbance, thus respond to improved habitat across a wider range of their distribution than those that have a narrow habitat preference. These factors may need to be considered when designing restoration activities as part of the step down implementation process."

Salmonids and Aquatic Habitat

Given the lack of existing quantification of actual harvestable population levels desired by tribes and the many factors besides habitat condition which influence fish populations, it is difficult to discern whether such levels would be attained by the proposed ICBEMP strategies. However, trends in habitat capacity can be used to indicate whether conditions that support harvestablility are improving. All alternatives would produce positive trends in aquatic habitat capacity for the six key salmonids, with trends in Alternative S2 being strongest. Alternative S1 would provide some overall habitat improvement due to application of restrictive measures throughout the region. However, Alternative S2 would show added improvement in selected areas where active restoration programs are implemented. Alternative S3 would show the lowest improvement because of uncertainty associated with RCA delineation and less

required hierarchical analysis preceding restoration actions. Regarding tribal interest effects, these results indicate conditions supporting harvestability would improve most under Alternative S2. These conditions would be most likely in A2 subwatersheds, high restoration priority subbasins, and areas currently with high habitat capacity (such as wilderness areas and A1 subwatersheds).

Population outcomes for the six key salmonids indicate that all alternatives would result in improved status. Overall, Alternative S2 would result in the most improvement followed by Alternative S1 and S3. Improvements in populations outcomes were not as substantial as changes in habitat capacity because many other biological constraints influence population status and distribution (Lee et al. 1997, Rieman et al. 1999). This influence is most notable for anadromous fish. Anadromous fish population outcomes, particularly those above several dams in the Snake River and Upper Columbia River, showed minor to no improvements because of the high uncertainty associated with migrant survival. For more detail on anadromous fish and cumulative effects see the Aquatic Effects section of this chapter.

Access

Access is a critical factor to American Indian peoples with regard to harvests of resources for cultural uses and practices. The presence of healthy and sustainable populations of culturally significant species in ethno-habitats is not sufficient if access to familiar ethno-habitat areas is precluded by physical barriers, socio-cultural restrictions, or change in land ownership.

Alternatives S2 and S3 may pose some limitations of access within A1, A2, or T areas, which may restrict the full range of Indian cultural uses. However, federal/tribal consultation processes should provide for adequate consideration of reserved rights to habitats and resources and allow for the continued use of treaty and cultural uses, assuming that federal/tribal collaboration and consultation typically has an end goal of consensus agreement. Conversely, road closures can also protect treaty and cultural uses and resources by limiting access to certain areas and places by others. Furthermore, pedestrian access may remain viable in some road closure situations, which would allow at least some access for tribal purposes.

Socio-economics

The socio-economics evaluation of alternatives includes the "bread-and-butter" issues of economic development and employment opportunities, as well as consideration of habitat and resource conditions

The socio-economics evaluation includes the "bread-and-butter" issues of economic development and employment opportunities, as well as habitat and resource conditions which contribute to social well-being, including cultural and historical preservation.

which contribute to social well-being issues, including cultural and historical preservation.

An assessment of Supplemental Draft EIS socio-economic affects on all communities, tribal and non-tribal, was performed by Crone and Haynes (1999). Regarding commodity outputs and their influence on community economies, the study indicates relatively few effects of the Supplemental Draft EIS alternatives on the region's populations. However, these may not be completely applicable to tribal communities because socio-economic issues and indicators used to characterize specialized communities do not necessarily apply to tribes and tribal communities.

Table 4-55 shows a relative ranking of 1, 2, or 3 to indicate a range from most to least, respectively, of how responsive management direction is to four primary areas of tribal social-economic issues, based on qualitative information and the description of the alternative.

Overview

Since typical socio-economic indicators do not readily lend themselves to characterization of reservation communities or the evaluation of effects on those communities and tribal rights and interests, the alternatives were evaluated on how well management direction responded to tribal basin-wide issues of employment and economics, and also on factors that contribute to social and economic conditions of tribal communities: subsistence and treaty uses and the associated protection and restoration of important species and habitats related to these uses.

Economics and Employment

Since the economy of most tribal communities is typically severely depressed and employment opportunities are limited compared to other communities in the basin, management direction in Alternatives S2 and S3 would be most responsive to tribal economic and employment issues because these alternatives emphasize the economic participation of tribal communities along with economically vulnerable

Table 4-55. Relative Effects of the Alternatives on Tribal Socio-economic Issues.

Issue Area	Alternative S1	Alternative S2	Alternative S3
Economics/employment emphasis	3	2	1
Subsistence and Treaty Use Considerations	3	2	1
Protection/restoration of important species/habitats	3	1	2
Cultural preservation	3	1	2
Socio-economic, overall	3	1	2

1 = Management direction most responsive to this subjects and basin-wide tribal issues; 3 = least responsive.

communities. Alternative S1 doesn't include this management direction emphasis and it does not include identification of high restoration priority subbasins.

Under Alternatives S2 and S3, basin-wide high restoration priority subbasins were selected in part based upon proximity to reservations and an opportunity to restore lands and resources of particular interest to American Indian tribes, as well as to provide employment and contracting opportunities to reservation communities. Alternative S3 includes all 16 tribal high restoration priority subbasins, compared to 11 in Alternative S2 and none in Alternative S1. This means that under Alternative S3, each of the 16 reservations within the basin would have at least one high restoration priority subbasin in their traditional homelands and in close proximity to their reservation. (It should be noted that high restoration priority subbasins are often grouped. While only one subbasin in a group may have been selected for high restoration priority, base level socio-economic direction that emphasizes tribal considerations would still apply to all subbasins in the project area.) This provides for greater opportunities for tribal businesses and people to participate in and benefit from restoration activities near their respective reservation. Benefits are not only for employment and community economics, but for subsistence, cultural, and treaty uses, as well as heightened influence on and involvement in restoration work in these high restoration priority subbasins.

Additionally, management direction in Alternatives S2 and S3 emphasizes the identification and use of authorities which provide for more targeted use of tribal businesses and enterprises, so that federal land managers are aware of the many authorities available to them to use Indian-owned businesses. There is also management direction on appropriately working with Tribal Employment Rights Ordinance (TERO) offices so federal managers better understand how tribes are organized and which departments can best assist them in working with tribal businesses and contractors. While these authorities and TERO offices exist under Alternative S1, there is no consistent management emphasis on their identification and use.

Training on federal Indian law and policy, as well as on tribal sovereignty and the rights and interests of American Indian tribes, is also emphasized under Alternatives S2 and S3, so that land managers understand the legal status of tribes and tribal governments well enough to explain it to non-Indian community leaders and others when needed. Again, this management emphasis is not well articulated under Alternative S1.

Subsistence and Treaty Use Considerations

Alternatives S2 and S3 would be most responsive to subsistence and treaty use considerations because they contain tribal consultation direction, which would provide for a more consistent and substantive involvement of tribes in all aspects of federal planning and decision-making processes than Alternative S1. This increased involvement would provide for greater consideration of tribal rights and interests, as would the use of multi-scaled assessment provided by Alternatives S2 and S3, with more requirements under Alternative S2. Alternative S1 does not consistently include this direction.

Protection and Restoration of Important Species and Habitats

Since the protection and restoration of resources also contributes greatly to subsistence, cultural, religious, and treaty uses, the evaluation criteria on for protection and restoration of important species and habitats are the same as those discussed under "Ethno-habitat Management" earlier in this section. Those criteria also contribute greatly to tribal social/economic implications and effects of the alternatives in this

regard would be the same: Alternative S2 the most responsive, followed by Alternative S3, followed by Alternative S1.

Cultural Preservation

The primary measure of effects on cultural preservation is the degree of information exchange and consultation promoted between the agencies and tribes. The importance of shared cultural experiences, values, and information between generations, and the significance of these activities for tribal cultural survival, are at the heart of cultural landscape preservation and tribal access to culturally significant places and resources. Allowance for American Indian elders' access to important places has implications for cultural survival and social well-being of tribes and for tribal sovereignty.

All alternatives would recognize the importance of places, including sacred sites, traditional use areas, and archaeological sites, to American Indians, through implementation of existing laws. However, as discussed earlier under Politico-legal Relations, processes for determining local management direction under Alternatives S2 and S3 are designed to more thoroughly proceed through the consultation process with tribes than is offered by Alternative 1. Recognition of place attachments across unit and agency boundaries would therefore more likely be achieved under Alternatives S2 and S3.

The effect of Alternatives S2 and S3 is expected to help bring about better sensitivity toward and incorporation of tribal rights and interests with regard to cultural preservation, through more effective and consistent consultation and collaboration and through focusing on ecologial restoration. Because Alternative S2 focuses on the special manage- ment of more acreage through step-down ecological restoration programs, it is ranked most responsive to tribal cultural interests. Alternative S1's strong reliance on existing land use plans and restrictive measures would provide a more limiting forum to coordinate protection of culturally important resources and locations, and access to them.

In summary, for socio-economic considerations, it appears that both Alternatives S2 and S3 would accommodate economic needs of the region's tribal communities beyond current levels (Alternative S1). Relative to tribes, under Alternatives S2 and S3, high restoration priority subbasins are purposefully located in proximity to tribal lands not only to maximize effects of habitat improvement, but also to increase employment potential. Jobs created by on-the-ground restoration programs would be much more accessible to tribal members. In addition, subsistence and treaty uses would gain from increased protection and/or restoration of federally administered lands. While Alternative S3 does focus on more acreage in proximity to tribal lands for restoration activity, and economic benefits would likely be greater for each of the tribal communities in the basin, the resultant gains in restoration and their contribution to overall ecosystem health and productivity would be higher under Alternative S2. Given the fact that tribal communities depend on federal lands for a myriad of uses and as an integral part of their culture, Alternative S2 would provide greater opportunity for improvement of the lands and resources than Alternatives S3, and greater than Alternative S1, which does not include this management direction emphasis.

Conclusions

Each of the three primary criteria—politico-legal relations, ethno-habitat management, and socio-economics— indicate that Alternative S2 would be the most responsive of the three Supplemental Draft EIS alternatives to tribal interests over the long term. The consistency is based on the pervasive theme of enhanced consultation and collaboration offered by Alternative S2, along with the benefits of increased multi-scaled analysis, economic emphasis of tribal communities, and the identification of basin-wide high restoration priority subbasins.

In summary, the effects of the three Supplemental Draft EIS alternatives on federal trust responsibility and tribal rights and interests are as follows:

Alternative S1 would offer no region-wide consistency in consultation, ecological restoration, economic benefits, and monitoring. The alternative also lacks the step-down processes that would address accountability and consistency. Historical trends of decline in habitats and resources of importance to tribes would be less effectively addressed. Protection of treaty-related resources and culturally important species would continue to be inconsistent across the project area, jeopardizing continued access and availability of ethno-habitat patches. The decline in species availability has in the past imposed substantial socio-economic impacts on Indian societies, disrupting all aspects of tribal community economies. Socio-cultural effects would continue to be pervasive under Alternative S1, reinforcing high unemployment rates and the inherent social problems associated with depressed economies. Continued decline in resource access and availability has negative implications to the relationship between tribal

people and the land and resources, which could disrupt subsistence and cultural uses. There could also be implications for economic gains in tourism, product manufacturing, and other facets of reservation revitalization currently experienced by some of the tribes.

Alternative S2 includes 11 subbasins in the basin-wide restoration strategy that are identified based on tribal factors. The economic strategies emphasize tribal involvement in restoration through use of tribally owned businesses and contractors. Step-down processes included in the alternative emphasize tribal involvement in restoration priority areas as well as other phases of planning and decision-making. Overall, more opportunities and consistency for tribal consultation would be offered, and basin-wide issues would be addressed on a basin-wide basis. Habitat would be improved in some regions, and declining trends would be slowed in most others. Alternative S2 would offer more long-term protection for current values, with less short-term risk. Ability to pursue traditional resource and land uses would be best served by Alternative S2 compared to the other alternatives. The long, complex process of habitat restoration would also better provide for the tribal exercise of treaty rights on public lands.

Alternative S3 includes restoration emphasis on 16 subbasins based on tribal factors. This increase over the 11 subbasins so identified in Alternative S2 would provide more economic benefits to all the tribes, since each would have at least one restoration subbasin in close proximity to their reservation. In addition, consultation would still be significant in Alternative S3, with continued Subbasin Review, some use of watershed analyses (EAWS), and NEPA consultations on project-specific work. However, the lesser analysis called for in Alternative S3 would decrease the level of certainty in the desired outcomes and provide less opportunity for tribes to "tier" responses at the appropriate scale to issues they raise. The goals of harvestability may be approached more quickly on a localized basis, but the short-term risks regarding harvestability would be higher than under Alternative S2.

Alternatives S2 and S3 both would respond better than Alternative S1 to protection and/or restoration of identified species of interest to tribes (Table 4-54), with Alternative S2 being somewhat more responsive than Alternative S3. Both Alternatives S2 and S3 contain management direction specific to: (a) a meaningful agency–tribal consultation process; (b) consideration of tribal rights and interests; (c) identification of basin-wide and tribal high restoration priority subbasins; (d) protection and/or restoration of important salmonid habitats and source habitats for terrestrial vertebrates of focus; (e) multi-scaled analysis; and (f) consideration of tribal restoration, project, and analysis priorities. However, Alternative S2 includes greater protection of key habitats, higher analysis requirements, and more restoration. Further, when reviewing the projections of landscape findings and overall aquatic and terrestrial projections of habitat trend for identified tribal species of interest, Alternative S2 appears to be more responsive than either Alternative S1 or Alternative S3.

Alternative S2 thus appears to be most responsive to honoring the federal trust responsibility and consideration of tribal rights and interests, because it provides more upfront direction (processes and prescriptions) and therefore greater certainty to tribes of consistent and accountable implementation. Alternative S2 would provide the highest levels of habitat protection for habitats of species most at risk than either Alternative S3 or Alternative S1. It also would be most responsive to the protection and/or restoration of resources and species significant to potentially affected tribes. Both Alternatives S2 and S3 have basin-wide strategies for aquatics, terrestrial, landscape, restoration, monitoring, and social/economics; Alternative S1 does not. Both Alternatives S2 and S3 include definitions and provisions for emphasis on tribal communities along with economically vulnerable and isolated communities in their social/economic direction. However, there is greater predictability in Alternative S2 than in Alternative S3 or Alternative S1 that risk will be managed conservatively and restoration will be focused where it most needs to occur.

Factors Influencing Ecosystem Health

Effects of the alternatives on ecosystem conditions discussed throughout this chapter relate to a variety of interconnected factors such as fire suppression, timber harvest, human demographics, insects and disease, livestock grazing, and noxious weeds. Many of these factors influence more than one resource or vegetation type–that is, they create unpredictable conditions that can affect of number of ecosystem resources regardless of whether the location is forestland, rangeland, or an aquatic or riparian area. They also affect each other, and their effects often cannot be separated.

This section discusses effects of the alternatives on fire regimes, timber harvest, the urban–rural–wildland interface, white pine blister rust, livestock grazing, and noxious weeds and other exotic undesirable plants, in a more integrated way than found elsewhere in this chapter. Additional effects on these and other factors more specific to individual resources or vegetation types can be found in the physical, terrestrial (upland) vegetation, terrestrial species, aquatic–riparian–hydrologic, and social–economic–tribal sections of this chapter. This Factors section concludes with a discussion of composite landscape effects, focusing on ecological integrity and landscape health (trends, and benefits/costs).

Summary of Key Effects and Conclusions

- Uncharacteristic wildfire effects on vegetation and soils would steadily decline and move toward historical conditions under all alternatives within rangeland PVGs (woodland, cool shrub, dry grass, and dry shrub) on BLM- and Forest Service-administered lands in the long term. The most substantative improvement (that is, over the largest portion of the project area) is projected under Alternatives S2 and S3, and least improvement in Alternative S1.
- Overall, Alternative S2 would be slightly better than Alternative S3, which is better than Alternative S1 at restoring fire regimes to a frequency and severity that would be more in line with the vegetation patches and patterns on the landscape. This would reduce the size, severity, and other unwanted effects of uncharacteristic wildfires. However, projections indicate that increased but moderate emphasis on restoration at a broad scale would not be enough to reverse the trends in fire regimes basin-wide. In the high restoration priority subbasins, fire regimes are expected to be closer to historical than elsewhere in the project area in the long term.
- In general, Alternative S1 is expected to produce somewhat larger logs, yet lesser volume of sawtimber than Alternatives S2 and S3. Alternatives S2 and S3 are expected to have more acres of timber harvest, thinning, and fuel reduction, all of which will produce wood products.
- The effects of timber harvest in combination with prescribed fire and wildfire on vegetation includes large expected differences in the old forest single-story structure. Alternative S2 would result in more of this scarce vegetative type than Alternative S3, which would result in substantially more than Alternative S1. Alternative S3 would reduce the extent of the mid seral forest toward historical levels more than Alternative S2, followed by Alternative S1. All alternatives are expected to slightly reduce levels of early seral forest to below historical levels.
- Project-wide, Alternatives S2 and S3 are expected to reduce the effects of uncharacteristic wildfire from current levels slightly more than Alternative S1 in the urban–rural–wildland interface. The improvements are due to increased concentrations of restoration activities in these interface areas.
- The only proxies for the effects of the alternatives on white pine blister rust in the long term are the changes in the western white pine and whitebark pine cover types. Both cover types are expected to expand under all alternatives, but western white pine would not achieve historical levels on Forest Service- and BLM-administered lands in the long term; Alternatives S2 and S3 would produce western white pine levels well above Alternative S1. Whitebark pine would expand almost to historical, with Alternatives S2 and S3

increasing levels slightly more than Alternative S1. However, much of this increase would come in the stand-initiation stage. In the important whitebark pine late seral single story vegetative type, there would be great reduction in all alternatives because of the effects of white pine blister rust.

- Livestock grazing effects over the long term would trend toward historical vegetative and soil conditions under all alternatives, within high restoration priority subbasins in both Alternative S2 and S3. Alternative S2 would achieve vegetative and soil conditions nearest to historical within high restoration priority subbasins because of the greater concentration of restoration activity per subbasin.
- While expansion of noxious weeds and other exotic undesirable plants would continue under all alternatives, Alternatives S2 and S3 would slow the expansion to a greater degree than Alternative S1. Over the long term, extent would decline within the aquatic A1 and A2 subwatersheds, within the terrestrial T watersheds, and within the high restoration priority subbasins, in Alternatives S2 and S3.

Fire and Fire Suppression

There is little similarity between historical and current succession/disturbance regimes within forested and rangeland ecosystems of the interior Columbia Basin. In the past 100 years, fires have generally become less frequent and more severe than historical times, affecting the vegetation patches, patterns, structure, and species composition. All of these features of vegetation along with other landscape characteristics have, in turn, a major influence on the predominant wildland fire regimes. Other factors also affect fire regimes: build-up of fuels, greater continuity in fuels, climate (including drought cycles), and increased suppression efforts, for example. Fire regimes are a cycle on the landscape, with fire influencing all of these factors, which in turn determine the frequency, severity, and patchiness of the fires.

All Supplemental Draft EIS alternatives are somewhat similar with respect to wildfire, in that they seek to reduce the severe effects and large extent of wildfire. However, they differ in their strategies. Alternative S1 emphasizes wildfire suppression mixed with fuel reduction, prescribed fire, and a small amount of "wildland fire use for resource benefit" (formerly called prescribed natural fire). The result would be some short-term successes and more future struggles with disturbance regimes. Alternatives S2 and S3 put more emphasis on prescribed fire, fuel reductions, small amounts of "wildland fire use for resource benefit", and increasing the fire-resistant vegetative types, in an attempt to make fire regimes more similar to historical and reduce the effects of uncharacteristic wildfire. Rather than trying to reduce the extent of all wildfire in general, the intent of Alternatives S2 and S3 is to make wildfire less destructive, by creating sustainable vegetation patterns and associated fire regimes that society and ecosystems can accommodate.

Prescribed Fire

Prescribed fire amounts are expected to differ greatly from Alternatives S2 and S3 to Alternative S1 on Forest Service- and BLM-administered lands in the long term. In forested landscapes, Alternatives S2 and S3 would show substantial increases in prescribed fire in many parts of the project area, while Alternative S1 would maintain current levels on average. Alternative S2 would treat 10 times more acres with fuel reduction activities and prescribed fire than Alternative S1; Alternative S3 would treat 8 times more acres with fuel reduction activities and prescribed fire than Alternative S1. On rangelands, Alternatives S2 and S3 would result in more modest increases in acres treated by prescribed fire in many parts of the project area, while Alternative S1 would probably cause slight reductions in prescribed fire from current levels on average, especially because of the need to keep fire out of areas with high concentrations of exotic annual grasses. Alternative S2 would treat 4 times more acres with fuel reduction activities and prescribed fire than Alternative S1. Alternative S3 would treat 3 times more acres with fuel reduction activities and prescribed fire than Alternative S1.

Overall, the largest increases in prescribed fire and other fuels management activities under Alternatives S2 and S3 would be found in the John Day-Snake RAC, the Southeastern Oregon RAC, the Upper Columbia-SalmonClearwater - R1 RAC, the Upper Columbia-Salmon Clearwater - R4 RAC, the Eastern Washington-Cascades PAC, and the Upper Snake River RAC.

"Wildland Fire Use for Resource Benefit"

In the short term, Alternatives S2 and S3 would have higher amounts of "wildland fire use for resource benefit" (formerly referred to as prescribed natural fire) than Alternative S1 on Forest Service- and BLM-administered lands. Alternatives S2 and S3 should be similar and slightly above current levels overall. "Wildland fire use for resource benefit" should slowly increase in the long term as it starts to take the place of prescribed fire. The largest increases are expected in the John Day-Snake RAC, the Eastern Washington-Cascades PAC, the Upper Snake River RAC, and the Southeastern Oregon RAC.

Wildfire

Alternative S1 generally attempts to reduce the amount of wildfire in order to reduce the severe effects of wildfire; suppression is the main focus. Alternatives S2 and S3 approach the problem by trying to balance wildfire levels with prescribed fire. While fire suppression is still important, it is only one component of the disturbance management strategy in the action alternatives.

Alternatives S2 and S3 are expected to lower the level of wildfire on Forest Service- and BLM-administered lands in the long term compared to Alternative S1 because of activities such as prescribed fire, "wildland fire use for resource benefit", and fuel reduction. Although the relative rank of alternatives would generally be the same, expected increases in the amount of wildfire are in the John Day-Snake RAC, the Upper Columbia-Salmon Clearwater - R4 RAC, and the Lower Snake River RAC. Several RAC/PACs could experience lesser increases in wildfire activity, led by the Upper Snake River RAC (all alternatives), and including the Eastern Washington-Cascades PAC (Alternative S1 only), the John Day-Snake RAC (Alternative S1 only), the Lower Snake River RAC (all alternatives), and the Upper Columbia-Salmon Clearwater - R4 RAC (all alternatives).

Looking specifically at high restoration priority subbasins, the differences among alternatives would be larger. In the areas that were identified under Alternative S2 as high restoration priority subbasins, Alternative S1 is expected to have twice the level of wildfire in the long term on Forest Service- and BLM-administered lands compared to Alternative S2. This is because Alternative S2 focuses restoration to these areas and increases the amount of prescribed fire and other restoration activities. In the areas that were identified under Alternative S3 as high restoration priority subbasins, the projected extent of wildfire is 2.5 times greater for Alternative S1 compared to what would occur in those same subbasins in Alternative S3 on Forest Service- and BLM-administered lands.

Total Fire Activity

Currently about one percent of the Forest Service- and BLM-administered lands in the ICBEMP project area are affected by fire activity on an average yearly basis. Fire activity is a combination of wildfire, prescribed fire, and "wildland fire use for resource benefit" (formerly referred to as prescribed natural fire). Alternative S1 should maintain current levels of fire activity, while Alternatives S2 and S3 would sharply increase fire activity, with Alternative S2 higher than Alternative S3 in the long term on Forest Service- and BLM-administered lands. The largest increases in fire activity are expected in the Southeast Oregon RAC, followed by the John Day-Snake RAC, the Butte RAC, the Upper Columbia-Salmon Clearwater - R4 RAC, and the Upper Columbia-Salmon Clearwater - R1 RAC. The Lower Snake River RAC is expected to show no increases, and the Upper Snake River RAC is expected to show declines in fire activity in the long term. Other RAC/PACs show lesser increases in fire activity.

Uncharacteristic Wildfire Effects

One of the ways to gauge the success of the alternatives at restoring disturbance regimes is to compare the effects of uncharacteristic wildfire. Fire will continue to be an important ecosystem process. However, when the fire regimes are in balance with the vegetation, landform, and climate, ecosystems are more resilient after disturbance and more sustainable in the long term. If effects of uncharacteristic wildfire are minimized, then ecosystems should be healthier.

Uncharacteristic wildfire effects are expected to increase slightly under Alternative S1 and decrease in Alternatives S2 and S3, with Alternative S3 slightly better than Alternative S2 on Forest Service- and BLM-administered lands in the long term (see Figures 4-16 and 4-17). In high restoration priority subbasins, the differences between Alternatives S2 and S3 and Alternative S1 would be substantially

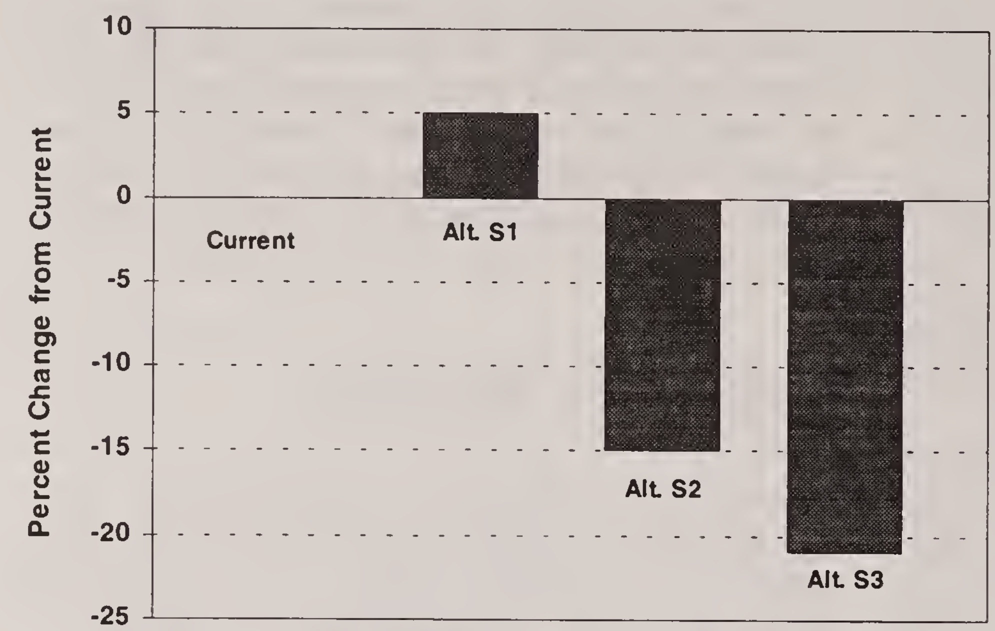


Figure 4-16. Change in Area Expected to Experience Uncharacteristic Wildfire, Long Term. Project Area = Forest Service- and BLM-administered Lands.

greater. These differences can be attributed to higher emphasis on restoration in Alternatives S2 and S3 and higher concentrations of restoration activities in the high restoration priority subbasins. Alternative S1 projections indicate further departures in fire regimes in the long term, resulting in more extensive and severe effects, compared to historical. (See Map 4-8.)

In A2 subwatersheds and T watersheds, effects would be similar to those in the high restoration priority subbasins: Alternatives S2 and S3 would reduce the amount of uncharacteristic wildfire compared to Alternative S1 for these same land areas. However, in wilderness areas, Alternatives S3 and S2 are expected to have similar uncharacteristic wildfire effects compared to Alternative S1. Furthermore, in areas designated as A1 subwatersheds in Alternatives S2 and S3, uncharacteristic wildfire effects would be greater under Alternatives S2 and S3 than Alternative S1. Maintenance and restoration of fire regimes are a high priority in T watersheds and somewhat less in A2 subwatersheds. Active restoration activities would be limited in A1 subwatersheds (Alternatives S2 and S3), and wilderness areas (all alternatives) because the emphasis there is on conservation.

Uncharacteristic wildfire effects on rangeland PVGs (woodland, cool shrub, dry grass, dry shrub) would generate increased chances that vegetative and litter cover would be reduced, root-binding capability in soil would be reduced, and the soil surface heated across large enough areas that collectively it would be likely to cause erosion events, reduction in riparian habitat condition, and increased stream temperatures. The native (historical) system, used as the benchmark for comparison, had no uncharacteristic wildfire effects as here defined.

Departure from Historical Range of Variability for Fire

Historical range of variability (HRV) refers to the normal range within which disturbance regimes, vegetation characteristics, and other ecological processes and functions fluxed over time. Departure from HRV is another way to measure how much disturbance regimes have changed or will be restored in the future. The higher the departure from HRV, the less desirable the effects.

Basin-wide, on Forest Service- and BLM-administered lands, average conditions would continue to move away from HRV in all alternatives, because it will take an extensive and concentrated restoration effort to stop and reverse trends across Forest Service- and BLM-administered lands. In most subbasins and many subwatersheds, extensive and concentrated restoration cannot occur because of protection of aquatic habitats (A1 subwatersheds), lack of access in roadless areas, and reliance on lightning ignitions for prescribed fire restoration in wilderness areas. However, trends could be reversed

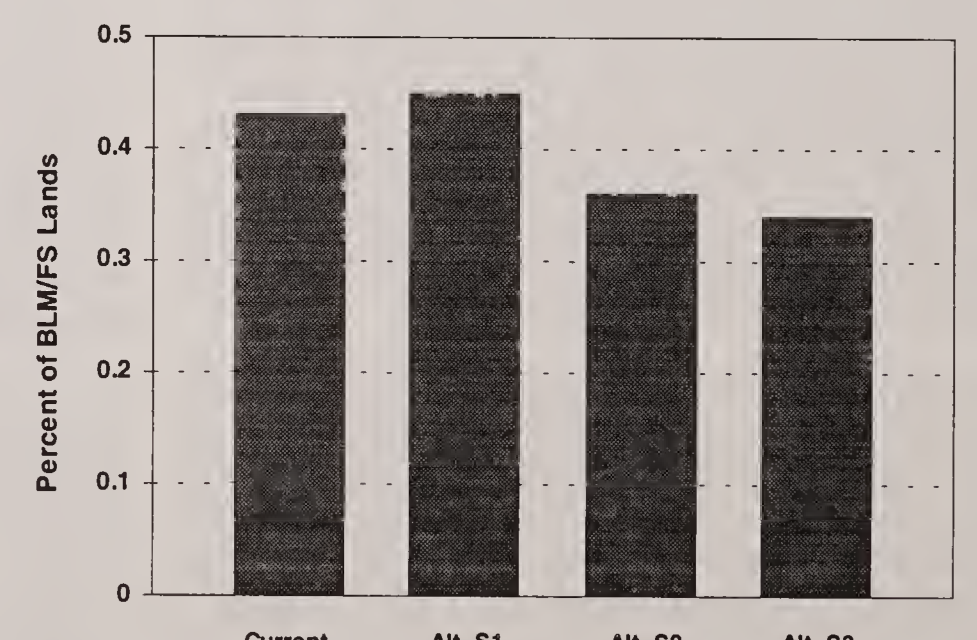
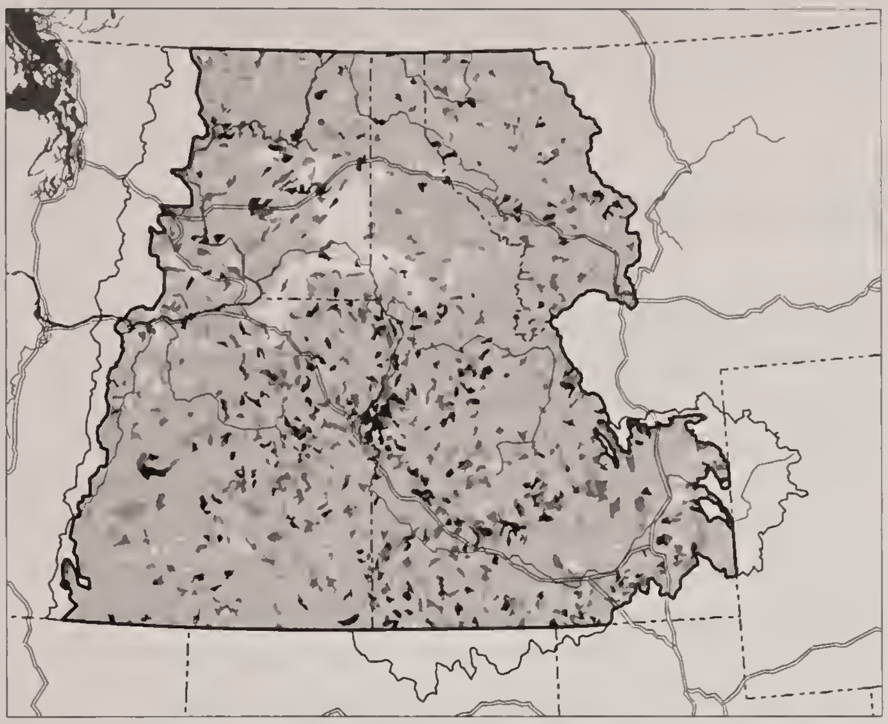
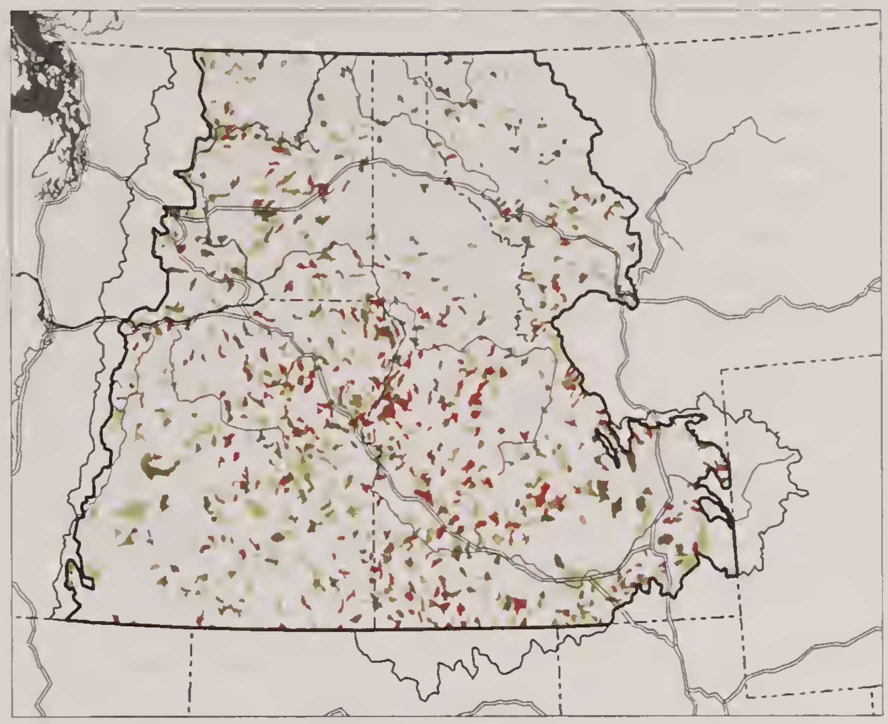


Figure 4-17. Percent of Area Expected to Experience Uncharacteristic Wildfire, Project Area, Long Term. Project Area = Forest Service- and BLM-administered Lands.



Current



Alternative S1

**Map 4-8.
Uncharacteristic
Wildfire Classes:
Change from Current**

Low
Moderate
High
Very High

Low to High/Very High
Moderate to High/Very High
Low to Moderate
High/Very High to Low
High/Very High to Moderate
Moderate to Low
No Change
Major Rivers
Major Roads
Supplemental Draft
EIS Area Border

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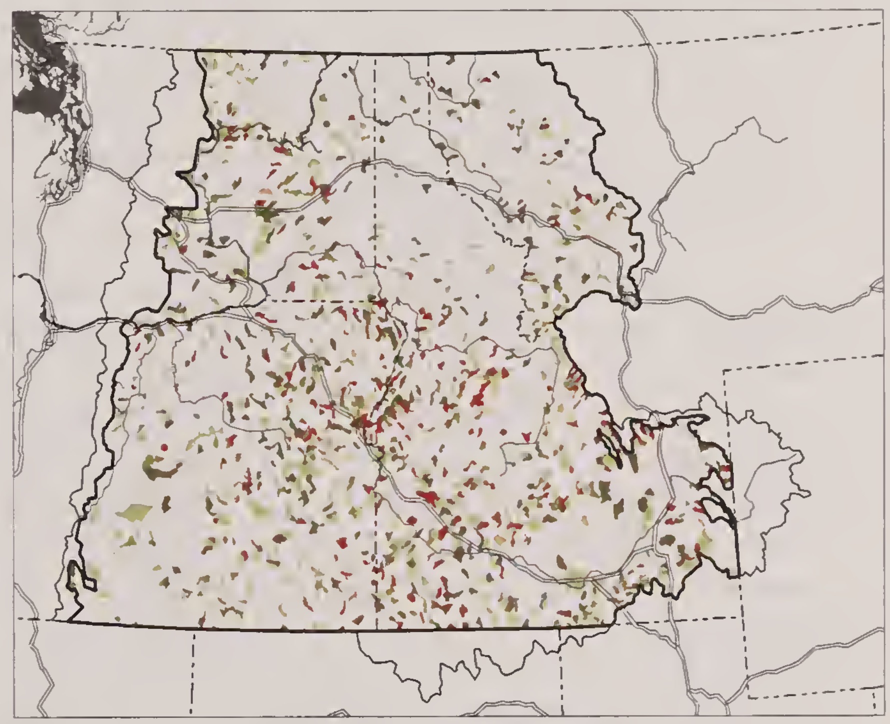
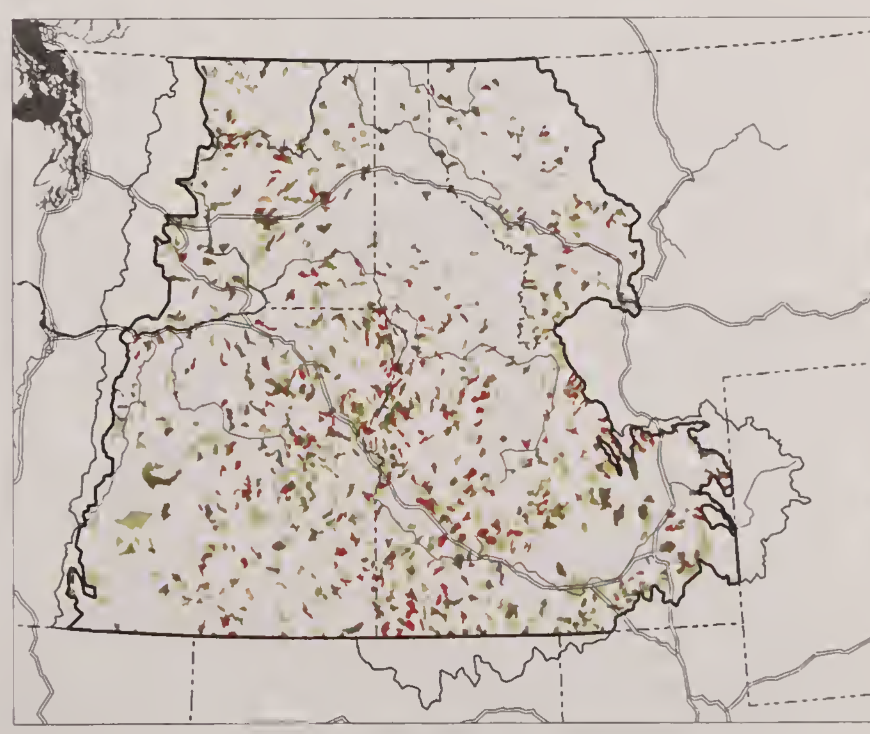


Alternative S2



Alternative S3

in subwatersheds that have reasonable access for restoration activities and where these activities are not constrained at a subwatershed scale by protection standards or reliance on lightning ignitions for prescribed fire. The average trend away from HRV would be most pronounced under Alternative S1, and least under Alternative S2, followed by Alternative S3; however, the differences between Alternatives S2 and S3 would be small (see Figure 4-18, Map 4-9). Substantial local reversals in subwatershed trends would be expected in Alternatives S2 and S3 in areas where most of the subwatershed is restored, while few subwatersheds would improve in trend in Alternative S1.

When looking specifically at high restoration priority subbasins, Alternatives S2 and S3 would not move away from HRV as much as they would when looking basin-wide. Therefore, when looking at high restoration priority subbasins, there would be a bigger difference between Alternatives S2 and S3 and Alternative S1 than when looking basin-wide. This is because of higher concentrations of restoration activities in high restoration priority subbasins in alternatives S2 and S3.

In A2 subwatersheds and T watersheds, the same relative rank among alternatives would be expected: Alternative S2 would be greater than or equal to Alternative S3 which would be greater than Alternative S1 for these same areas. HRV departure in A2 subwatersheds would be less than it would be basin-wide; it would be maintained near current levels in T watersheds under Alternatives S2 and S3 because of higher priorities of restoration and maintenance of disturbance regimes. HRV departure is expected to increase in A1 subwatersheds (Alternatives S2 and S3) and wilderness areas (all alternatives) because of limited amounts of restoration activities.

On rangelands on BLM- and Forest Service-administered lands in the long term, uncharacteristic wildfire effects would trend toward historical range of variability under all alternatives and in all areas, including project area-wide, except for high restoration priority subbasins in Alternatives S2 and S3, where no trend would be evident. Alternatives S2 and S3 would be similar in achieving conditions that are nearest to historical in A1 and T areas, and Alternative S2 would achieve those conditions in A2 and high restoration priority subbasins. Alternatives S2 and S3 also would be similar in achieving conditions nearest to historical for all other Forest Service- and BLM-administered lands, and the project area as a whole.

Summary: Fire

Overall, Alternative S2 would be slightly better than Alternative S3, which is better than Alternative S1 at restoring fire regimes to a frequency and severity that would be more in line with the vegetation patches and patterns on the landscape. This would reduce the size, severity, and other unwanted effects of uncharacteristic wildfires. Prescribed fire on the landscape, at the rates projected in Alternatives S2 and S3, would mean breaks in fuel continuity, lower suppression costs, and better success in suppression efforts compared to Alternative S1. It would mean greater sustainability of cover types and structural stages that have evolved with fire and are adapted to historical fire regimes. With greater sustainability of ecosystems, comes more predictability of the products and uses of the ecosystem.

However, projections indicate that increased but moderate emphasis on restoration at a broad scale would not be enough to reverse the trends in fire regimes basin-wide, because reversing trends would take extensive and intensive investments in restoration as is intended for the high restoration priority subbasins under Alternatives S2 and S3. The analysis indicates that restoration activities, when highly concentrated in high restoration priority subbasins, make a difference. In the high restoration priority subbasins, fire regimes are expected to be closer to historical than elsewhere in the project area in the long term.

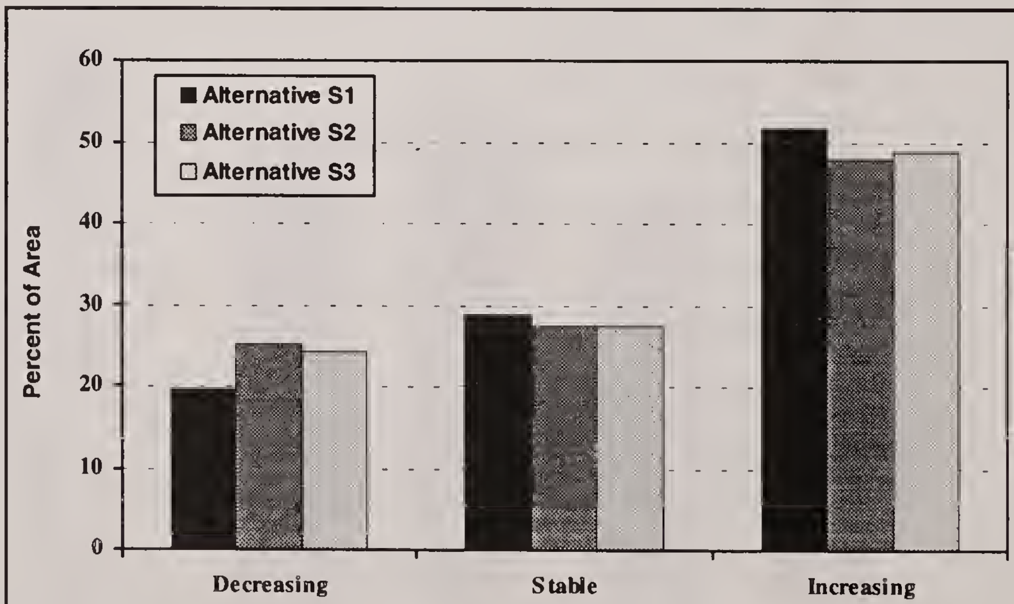


Figure 4-18. Historical Range of Variability Departure Trends, by Alternative, Project Area.
Project Area = Forest Service- and BLM-administered Lands.

Map 4-9.
Historical Range of Variability Departure Classes (Change from Historical)

- Low
- Moderate
- High
- Major Rivers
- Major Roads
- Supplemental Draft EIS Area Border

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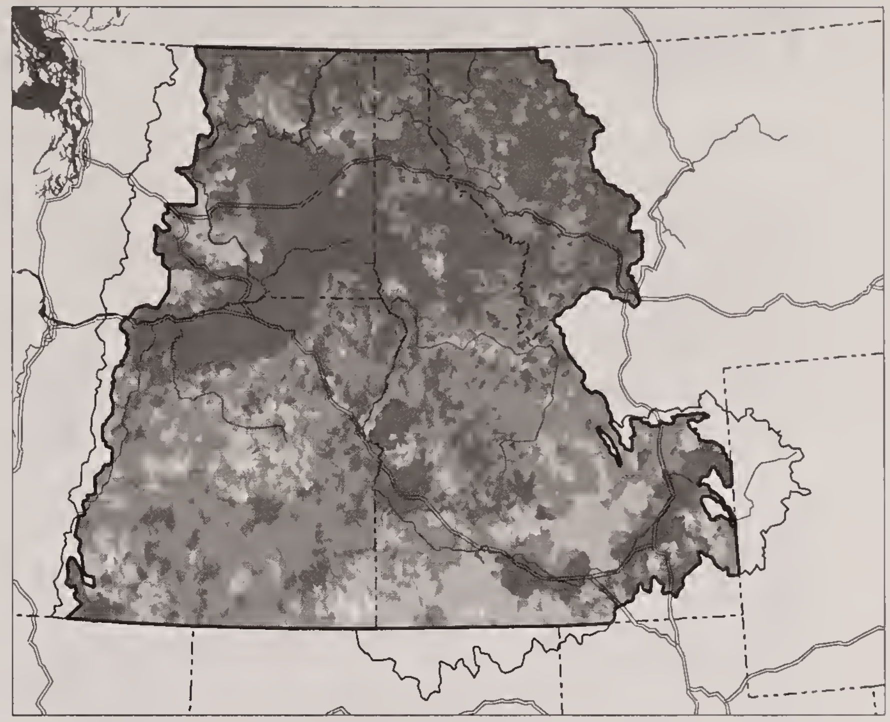
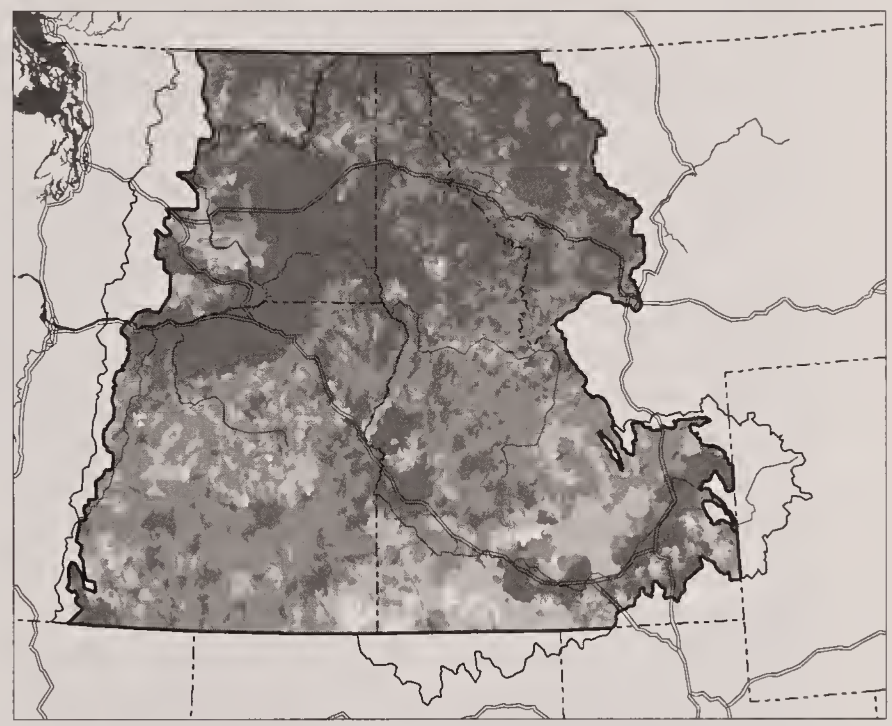
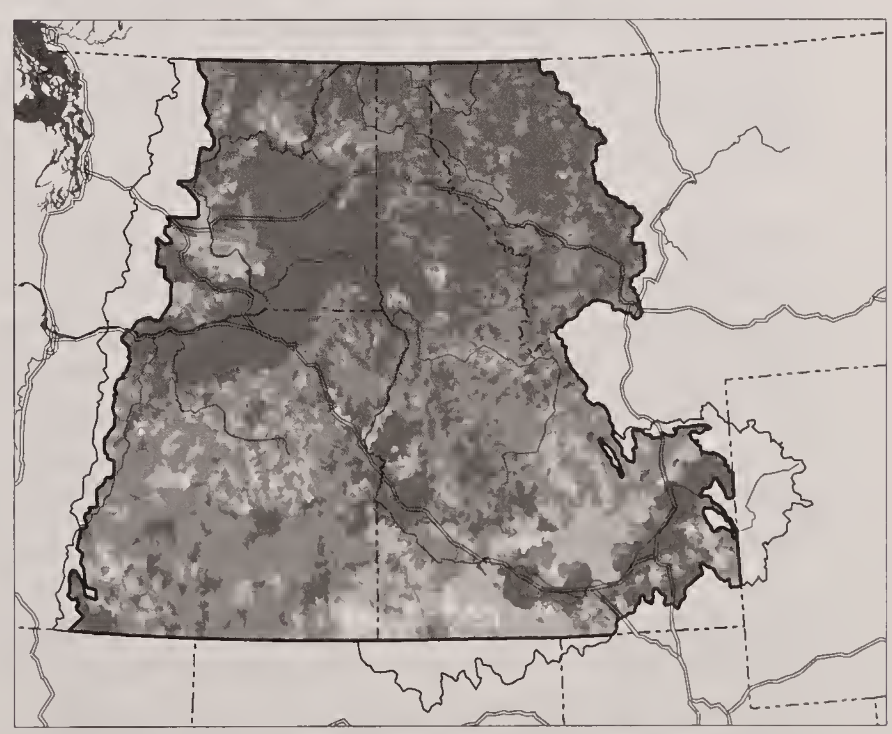


Alternative S1



Alternative S2



Alternative S3

Timber Harvest

Over the years, timber harvest has had positive impacts on growth in northwest U.S. economies, communities, businesses, and families. Timber harvest has provided livelihoods and careers, and it has been a way of life for many. The benefits of the many wood products to society are also important.

Timber harvest has also had impacts on the forests and their ecosystems of the project area. Timber harvest and other forest management practices, along with fire suppression, have changed disturbance regimes, natural succession pathways, and vegetation patterns. Roads built to access timber have led to secondary effects, some harmful and some beneficial.

Timber harvest methods are a reflection of the desires of society and will continue to be important socially and ecologically in the future. There would be a difference in the kind of timber harvest among the alternatives. Alternatives S2 and S3 would use stewardship harvest as a restoration tool, focusing on the ecological function of the remaining forest. The largest trees are more likely to remain, as are the more fire-resistant and shade-intolerant trees. Stewardship harvest often uses "thinning from below" methods to give growing space to the overstory trees, reduce fuel levels, and/or remove fuel ladders. Sometimes this includes large openings that allow shade-intolerant species to regenerate. Stewardship harvest can be an effective tool in restoring vegetation patterns and disturbance regimes. Alternative S1 would incorporate a high proportion of traditional timber harvest and a smaller proportion of stewardship harvest, much like the predominate practices of the past 30 to 40 years. An important focus of traditional harvest (Alternative S1) has been harvesting the best timber, often the largest and most fire-resistant trees, and mitigating the effects on other resources such as wildlife and streams.

There are also differences in the outputs of timber harvest among the alternatives in the short term. In general, Alternative S1 is expected to produce somewhat larger logs, yet lesser volumes of sawtimber than Alternatives S2 and S3. Alternatives S2 and S3 are expected to have more acres of timber harvest, thinning, and fuel reduction, all of which will produce wood products.

The effects of timber harvest in combination with prescribed fire and wildfire on vegetation includes large expected differences in the old forest single story structure. Alternative S2 would result in more of this scarce vegetation type than Alternative S3, which would result in substantially more than Alternative S1. Alternative S3 would reduce the extent of the mid seral forest toward historical levels more than Alternative S2, followed by Alternative S1. All alternatives are expected to slightly reduce levels of early seral forest to below historical levels.

Urban–Rural–Wildland Interface

In low to mid elevation forests and rangelands, urban areas and rural developments continue to encroach on wildlands even as the fire risk in these areas has continued to increase. As wildfires become more severe, the associated hazards to life and property have increased, as have wildfire suppression costs. Several activities can reduce the fire risk in the urban–rural–wildland interface, including: timber harvest, thinning, prescribed fire, fuel reduction activities, greenstrips, brush reduction, adequate access for suppression, and responsive, effective suppression efforts. While prescribed fire is not without risks of its own, in general it is safer to burn under the closely calculated conditions of prescribed fire than to chance a wildfire when fuels are extremely dry and weather conditions are unfavorable.

Improvements (reductions) in uncharacteristic wildfire effects can be interpreted as a reduction in the wildfire danger. Basin-wide, Alternatives S2 and S3 are expected to reduce the effects of uncharacteristic wildfire from current levels slightly more than Alternative S1 in the urban–rural–wildland interface. The improvements are due to increased concentrations of restoration activities in these interface areas.

Another measure of future trends in the urban–rural–wildland interface is departure from historical range of variability. If vegetation structure, species composition, and disturbance regimes are more like historical ranges, then disturbances should have effects that are more similar to historical and less severe, resulting in less fire danger overall. In addition to vegetation similarity and disturbance regimes, HRV departure is also based on landscape patch and pattern. There is not much chance of improving HRV departure in the urban–rural–wildland interface because of limited ability to improve vegetation patch and pattern. However, analysis of HRV departure can provide a context for comparison between alternatives.

Basin-wide, Alternative S2 would reduce the extent of HRV departure in the urban–rural–wildland interface compared to Alternative S1. Alternative S3 is expected to be intermediate. HRV departure under Alternatives S2 and S3 is expected to be below current levels, while Alternative S1 would be slightly above. The main reason for the expected reductions in fire risk (based on HRV departure) is the increased emphasis on and higher concentration of restoration activities in the urban–rural–wildland interface under Alternatives S2 and S3.

Within high restoration priority subbasins where there are also urban–rural–wildland interface areas, Alternatives S2 and S3 are expected to greatly reduce the HRV departure well below current levels. Alternative S1 would allow HRV departure to get slightly higher than current levels. These effects would be caused by a combination of increased emphasis on and higher concentration of restoration activities in the high restoration priority subbasins and in the urban–rural–wildland interface under Alternatives S2 and S3.

White Pine Blister Rust

White pine blister rust is the primary introduced disease that has changed successional pathways, species, and structures of the cold and moist forest potential vegetation groups. It has already devastated the moist forest through the reduction of the western white pine by 95 percent. Blister rust-resistant varieties of western white pine have been developed and the road to recovery is now underway. The effects of white pine blister rust in the cold forest have been slower to start and gain momentum because of slower growth and development processes in the cooler environment, and less human access in the cold forest PVG to spread the disease. However, from modeled projections of vegetation in the project area, it appears that whitebark pine in the cold forest is on the same track as western white pine in the moist forest.

The only proxies for the effects of the alternatives on white pine blister rust in the long term are the changes in the extent of western white pine and whitebark pine. The extent of western white pine is expected to expand under all alternatives but not achieve historical levels on Forest Service- and BLM-administered lands in the long term. Alternatives S2 and S3 would increase the extent well above Alternative S1.

All alternatives are expected to increase the extent of the whitebark pine on Forest Service- and BLM-administered lands in the long term almost to historical levels. Alternatives S2 and S3 would increase extent slightly more than Alternative S1. However, much of this increase would come in the stand-initiation stage, showing an effort to restore the species. But in the important whitebark pine late seral single story vegetation type, there would be great reduction in all alternatives due to the effects of white pine blister rust. In the cold forest PVG where vegetation growth and development, succession, and restoration are slow, the problem of white pine blister rust will take a long time to overcome.

Livestock Grazing

Livestock grazing effects are defined as land areas where changes of more than 20 percent from the historical (native) vegetation composition and structure, soil cover, and soil surface characteristics are evident. These changes can reduce native species habitat quality, vegetation and litter cover, root binding capability, and riparian condition; and they can increase the probability of soil erosion and compaction, noxious weeds and exotic undesirable plant presence and abundance, stream bank erosion and failure, and stream temperature. The historical system, used as the benchmark for comparison, had no domestic livestock grazing effects because it predated the beginning of domestic livestock grazing in the project area.

Livestock grazing effects in this section reflect effects analyzed at the subwatershed level. Entire subwatersheds were classified as being either high, moderate, low, or none for livestock grazing effects. The proportion of the subwatershed showing these livestock grazing effects increases as the classification system runs from none to high. The high and moderate classes encompass broad ranges. For example, the high class means that somewhere between 55 and 100 percent of a subwatershed's area shows livestock grazing effects (as defined above), whereas the moderate class means that somewhere between 5 and 55 percent of a subwatershed's area shows livestock grazing effects. Thus, very few subwatersheds with BLM- and Forest Service-administered lands that

have been or are currently being grazed by livestock show no livestock grazing effects. The majority of subwatersheds that are rangeland-dominated by the dry shrub PVG and that have been or are currently being grazed are in the high class (Map 4-10).

The broad range of the high and moderate classes creates a situation where moving a subwatershed from a high to a moderate or from a moderate to a low class (meaning a trend in livestock grazing effects toward historical vegetation and soil conditions—improvement in rangeland condition), requires changes in livestock grazing management across a substantial area of the subwatershed. Changes that are not large enough to cause a change in class (for example, changes that occur in localized areas within subwatersheds) nevertheless in reality can cause substantial improvement within a subwatershed. Localized improvements in rangeland condition (for example within a riparian area along a portion of a stream reach, or on upland areas within a portion of a pasture within an allotment) will likely not be detected across the entire subwatershed. Thus localized improvements in rangeland condition attributable to changes in livestock grazing management will be the first observable signs of improvements attributable to livestock grazing management direction under any of the alternatives. However, because it takes a substantial amount of improvement to show a change at the subwatershed level, in most cases it will take a long time before subwatershed-level improvement is detected.

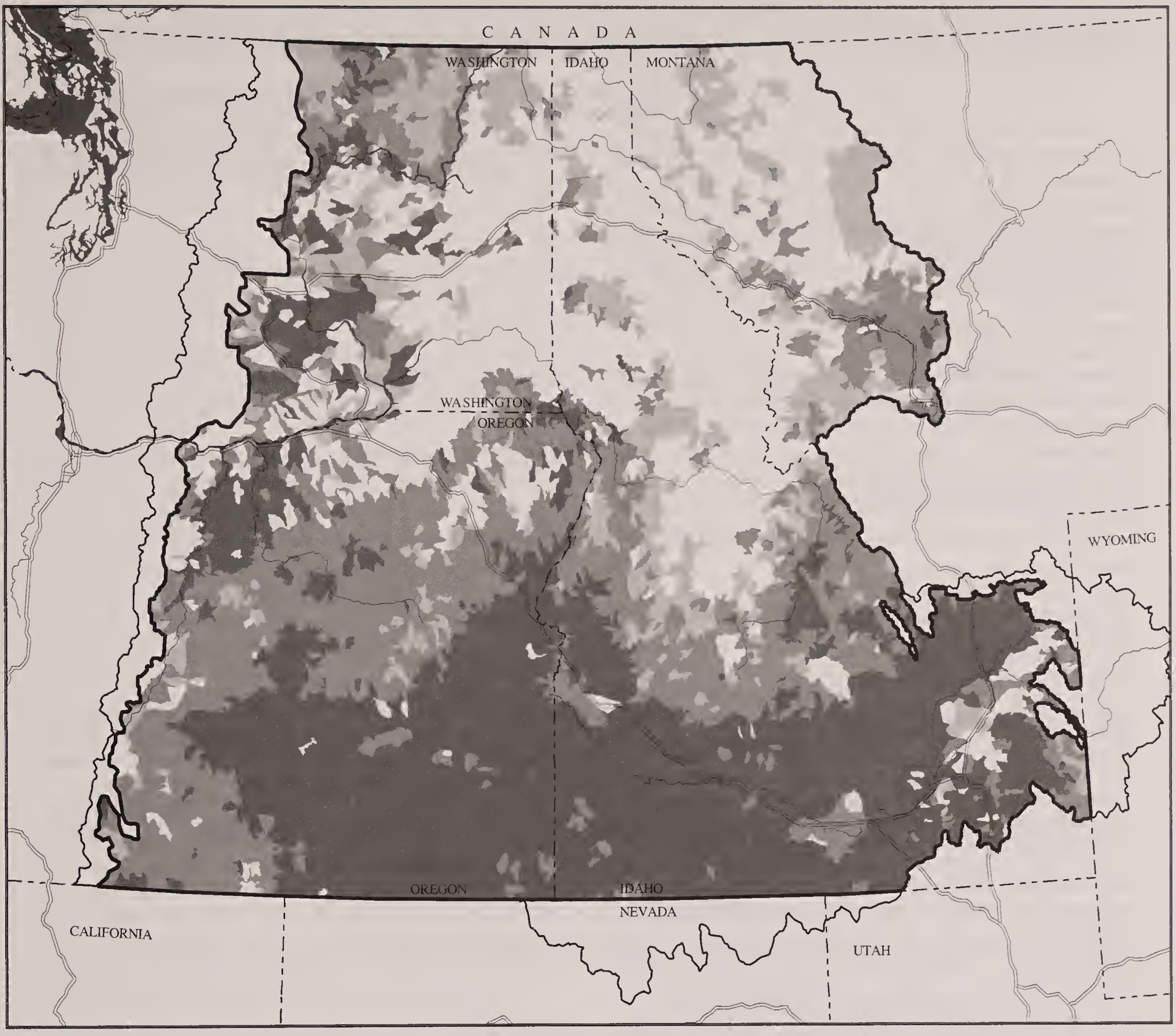
In summary, localized improvements would be masked. Localized improvements in rangeland condition attributable to changes in livestock grazing management would occur in addition to the improvements discussed below at the subwatershed level.x

Livestock grazing effects would trend toward historical vegetative and soil conditions over more extensive portions of the project area (9 of 12 RAC/PACs) in Alternative S2 than in Alternatives S3 (8 of 12 RAC/PACs) and S1 (7 of 12 RAC/PACs) (see Table 4-56). Confidence in the long-term trends is relatively high for the RAC/PACs with livestock grazing effects over extensive acreage currently (Deschutes PAC, John Day-Snake RAC, Klamath PAC, Lower Snake River RAC, Southeastern Oregon RAC, Upper Columbia-Salmon-Clearwater RAC-R4, and Upper Snake River RAC). In these RAC/PACs, Alternative S2 would consistently achieve vegetative and soil conditions over the long term that are nearest to historical, whereas Alternative S3 would often be similar but not consistently as positive.

Livestock grazing effects, over the long term and throughout the project area, would trend toward historical vegetative and soil conditions, under all alternatives, and in particular within high restoration priority subbasins in both Alternatives S2 and S3. Alternative S2 would achieve vegetative and soil conditions nearest to historical within high restoration priority subbasins because of the greater concentration of restoration activity per subbasin.

Changes in livestock grazing management are more likely to cause localized improvements and to trend livestock grazing effects toward historical vegetation and soil conditions on sites that have not crossed a threshold (within the state-and-transition model of vegetation succession [see Chapter 2]) to a more degraded state, than on sites that have crossed a threshold (Archer and Smeins 1991; Johnson and Kingery 1999). Examples of degraded steady states are: (1) western juniper-dominated sites that used to but no longer support a well-distributed and diverse a shrub and herb understory, show soil loss in the A horizon and would experience less frequent and mo e intense fire compared to historical; and (2) exot c annual grass-dominated sites that lack perenni l shrubs, forbs, and grasses; lack biological crusts; a d would experience more frequent fire compared o historical. On these degraded sites that have cross d a successional threshold, restoration activities (in t e form of prescribed burning, tree thinning, herbici e treatments, rehabilitation seedings, and other intensive practices) are necessary to reverse the degrad d condition and reverse the successional momentu Changes in livestock grazing management alo e would not be likely to do the job. Even if intensi e restoration activities are applied onsites that ha e crossed a threshold, historical vegetation and so l conditions would be predicted to reestablish slowly r not at all, attributable to ecological, technical, a d financial restraints (Tausch 1998; Johnson a d Kingery 1999). Intensive restoration activities c n prevent further degradation by establishing so e perennial plant species, reducing the dominance f exotic undesirable plants, lessening fire risk, a d promoting conditions favorable for biological cru t developmen

On sites that have not crossed a threshold, some c n be determined to be functioning and others can e determined to be functioning "at risk," based n physical (such as soil) and biological (such as biological crusts or plant cover) indicators of rangela d health (USDI/BLM 1999). Those that are functioni g "at risk" are at risk of crossing a successional threshold to a degraded state. In both kinds of sites, localized improvements discussed previously would e likely if changes are made to livestock grazing management. If livestock grazing is determined to be a factor that had caused the site to be functioning t risk, then changes made to livestock grazing manag-



Map 4-10.
Livestock Grazing Effects Classes: Current

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Table 4-56. Trends in Livestock Grazing Effects,[1] Project Area, Current to Long Term.[2]

	Trend Toward (T), or Away (A) from Historical Conditions Alt. S1	Alt. S2	Alt. S3	Alternative that Would Achieve Conditions Nearest to Historical
Butte RAC[3]	A	A	A	S2=S3
Deschutes PAC[4]	A	T	T	S2=S3
Eastern Washington Cascades PAC[3]	No trend	A	A	S1
Eastern Washington RAC[3]	T	T	T	S1=S2=S3
John Day-Snake RAC[4]	No trend	T	T	S2
Klamath PAC[4]	T	T	T	S2=S3
Lower Snake River RAC[4]	T	T	T	S2
Southeastern Oregon RAC[4]	T	T	T	S2=S3
Upper Columbia-Salmon-Clearwater RAC R1[3]	No trend	T	No trend	S2
Upper Columbia-Salmon-Clearwater RAC R4[4]	T	T	T	S2=S3
Upper Snake River RAC[4]	T	T	T	S2=S3
Yakima PAC[3]	T	No trend	No trend	S1=S2=S3
High Restoration Priority Subbasins in Alt. S2	T	T	T	S2
High Restoration Priority Subbasins in Alt. S3	T	T	T	S2=S3
Project-Area	T	T	T	S2

Abbreviations used in this table:
RAC = Resource Advisory Council
PAC = Provincial Advisory Committee
Alt. = Alternative
R1 = Forest Service Northern Region
R4 = Forest Service Intermountain Region

[1] Livestock grazing effects are land areas within subwatersheds where changes of more than 20% from the native (historical) vegetative composition and structure, soil cover, and soil surface characteristics are evident. These changes attributable to livestock grazing can (sometime during the current to long-term period) or might have already (sometime during the historic to current period) reduce(d) native species habitat quality, vegetative and litter cover, root binding capability, riparian condition, and increase(d) the probability of soil erosion and compaction, exotic undesirable plant presence and abundance, stream bank erosion and failure, and stream temperature. The native (historical) system, used as the benchmark for comparison, had no domestic livestock grazing effects because it predates the beginning of domestic livestock grazing in the project area.

[2] The current to long-term period for livestock grazing effects refers to the average of these effects over the 100 year time period and does not refer to the effects observable at exactly year 100.

[3] Relatively low confidence in current to long-term trends, attributable to relatively low amounts of acreage of livestock grazing effects at current.

[4] Relatively high confidence in current to long-term trends, attributable to relatively high amounts of acreage of livestock grazing effects at current.

Project Area = BLM- and Forest Service-administered lands

ement would help prevent these sites from crossing a threshold. This depends on being able to prevent exotic undesirable plants (such as noxious weeds) from invading or increasing, which would negate the benefits accrued to the changes in livestock grazing management.

For BLM- and Forest Service-administered lands in the project area, livestock grazing effects would trend toward historical vegetative and soil conditions under all alternatives, with Alternative S2 achieving vegetative and soil conditions that are nearest to the historical. For non-BLM- and Forest Service-administered lands, livestock grazing effects would decline in the long term similarly under all alternatives, but the trend would not be as strong as that predicted for BLM- and Forest Service-administered lands.

Livestock grazing effects that trend toward the historical can reflect many different changes in vegetative and soil conditions. Some notable examples include vegetative type changes, such as woodlands to shrublands, as mentioned in the Upland Vegetation section in this chapter; trends in biological crust development and extent (see Terrestrial Species section); trends in noxious weeds and exotic undesirable plants; trends in wildfire frequency and severity; and trends in aquatic and riparian habitats.

Noxious Weeds and Other Exotic Undesirable Plants

As discussed in other sections in this chapter, noxious weeds and other exotic undesirable plants would continue to expand in acreage over time in the project area as a whole, under all alternatives. Expansion would happen primarily in the dry forest, woodland, cool shrub, dry grass, and dry shrub PVGs.

While expansion of noxious weeds and other exotic undesirable plants would continue under all alternatives, Alternatives S2 and S3 would slow the expansion to a greater degree than Alternative S1. Alternatives S2 and S3 would implement project-area-wide Integrated Weed Management (IWM) strategy(ies) throughout the Forest Service- and BLM-administered land within the project area, whereas Alternative S1 lacks a comprehensive focus on IWM. In Alternatives S2 and S3, IWM is prioritized highest for implementation to aquatic A1 and A2 subwatersheds, and terrestrial source habitats that have declined substantially in geographic extent from historical to current periods within terrestrial T watersheds. These areas contain aquatic habitats that support important fish populations (A1 and A2 subwatersheds), and terrestrial source habitats that are the most sustainable through time. Weed control that is prioritized in these areas would solidify those areas as "anchor points" necessary for a long-term creation of a network of secure and productive habitats within the project area. Wherever IWM occurs, implementation priorities are built based on those vegetative cover types that are rated High, Moderate, and Low for Susceptibility to Invasion by noxious weeds (see Chapter 2). Prioritizing implementation based on vegetative type susceptibility will focus weed prevention and control on vegetative types most at risk to weed invasion and spread, many of which also happen to be in short supply currently (for example the wheatgrass bunchgrass and fescue-bunchgrass cover types).

Although expansion of noxious weeds and other exotic undesirable plants would continue for the project area as a whole, over the long term extent would decline within the aquatic A1 and A2 subwatersheds, within the terrestrial T watersheds, and within the high restoration priority subbasins, in Alternatives S2 and S3. Both Alternatives S2 and S3 within the high restoration priority subbasins, would arrest the expansion of exotic undesirable plants, with Alternative S2 achieving slightly more decline in extent (acreage) of exotic undesirable plants than Alternative S3. Restoration activity that would result in long-term declines in exotic undesirable plants include the following: (1) integrated weed control actions, such as herbicides and biological control (insects, fungi); (2) wildfire pre-suppression activities, such as greenstripping, which effectively acts as a weed prevention technique; (3) rehabilitation seedings, which will retard weed dominance and spread; and (4) changes in livestock grazing management that reduce soil surface disturbance and increase persistence of native vegetation.

There would be a greater concentration of these restoration activities in the high restoration priority subbasins in Alternative S2 compared to Alterna-tive S3. In general, the high restoration priority subbasins were selected based on having a moderate to high opportunity at the subbasin scale for restoration activities to actually be successful in achieving restoration.

Outside the area where IWM is prioritized (that is, outside aquatic A1 and A2 subwatersheds, outside terrestrial T watersheds, and outside high restoration priority subbasins), noxious weeds and exotic undesirable plants would continue to expand in the long term. In these areas, Integrated Weed Management direction would achieve a slowdown in the rate of expansion under Alternatives S2 and S3, but the intensity of effort would not be enough to completely stop or reverse the trend in weed expansion. The expansion of noxious weeds and other exotic undesirable plants in rangelands, particularly the dry shrub PVG, has not slowed because of: (1) the extent of the infestations (for example, cheatgrass is found in every county in the project area); (2) the numerous ways that noxious weeds and other exotic undesirable plants are spread; (3) the adaptability that noxious weeds and other exotic undesirable plants show; and (4) the ability of some species (such as yellow starthistle, spotted knapweed, dalmatian toadflax) to invade areas even without any disturbance to the soil surface. These conditions would hinder effective weed prevention and control.

Composite Landscape Effects

As described in Chapters 1 and 2, changed conditions over the past century and new information and understandings indicate that the ecosystems of the interior Columbia River Basin are declining in health.

The purpose of the proposed action of this Supplemental Draft EIS is to take a coordinated broad-scale approach and select a management strategy that best achieves a combination of the following: (1) restore and maintain long-term ecosystem health and ecological integrity; and (2) support economic and/or social needs of people, cultures, and communities through availability of sustainable and predictable levels of products and services from lands administered by the Forest Service or the BLM. This chapter has looked at the effects of the alternatives on the individual components of ecosystem health such as repatterning of vegetation, uncharacteristic disturbances, aquatic habitat quality, and socio-economic resiliency of tribes and communities. This section will attempt to address the question of how the alternatives affect the health of the ecosystem as a whole. The primary integrated outcomes are reflected in the trends in ecological integrity, and landscape health trends and benefit/cost.

Ecological Integrity

Ecological integrity is an attempt to show the integrated condition of the biophysical environment within the project area (Quigley, Hann, Haynes, et al. 1999). Aquatic contributions to ecological integrity (that is, habitat conditions) were shown to be generally either stable or improving. For the most part, changes in activity levels and changes in the kinds of activities of the recent past, coupled with the direction to conserve or restore aquatic systems, should result in either stable or improving conditions from an aquatic perspective, with Alternative S2 better than Alternative S1 followed by Alternative S3.

Terrestrial contributions to overall ecological integrity trends were developed from proxy variables (historical range of variability departure, uncharacteristic grazing, topography, landscape vegetation patterns, snags and downed wood, fire disturbances, predicted road densities, the presence of domestic livestock, and human population densities), rather than from estimates of source habitat amounts or species outcomes. These contributions to ecological integrity should be mostly stable in subbasins dominated by rangeland systems and should show improving trends in forested environments. Differences among alternatives should be evident, especially in areas with higher concentrations of restoration activities such as high restoration priority subbasins in Alternatives S2 and S3. Alternatives S2 and S3 should show better trends from a terrestrial perspective than Alternative S1 (Quigley, Hann, Haynes, et al. 1999).

Contributions of landscape variables to overall integrity trends were mixed. Subbasins showing the strongest declines in ecological integrity, from a landscape perspective, should be areas where restoration activities are not effective in reversing succession, disturbance règimes, and exotic plant invasion. This may be due to lack of priority; limits on restoration activities in A1 subwatersheds, wilderness areas, roadless areas, or other restrictive areas; or to lack of restoration technology, such as in the driest parts of the rangelands. For most ecosystems in the project area, passive restoration approaches will not shift altered successional pathways of vegetation back to those that are more characteristic of historical conditions. Active restoration and maintenance techniques would be necessary to reverse the momentum of uncharacteristic succession and disturbance and reduce the uncharacteristic disturbance effects. The subbasins showing improved conditions largely coincide with the high restoration priority subbasins. In these areas, prioritizing restoration would pay off by reversing the momentum of uncharacteristic succession and disturbance and create conditions more similar to historical conditions in Alternatives S2 and S3 than in Alternative S1 (see Map 4-11) (Quigley, Hann, Haynes, et al. 1999).

Wildfire, insects and disease, exotic plant invasions, and drought will continue to play a large role in shaping the ecosystems of the project area. The effects analysis shows that even in 100 years, evidence of improvements would be slow for all alternatives. However, a hands-off approach to restoration should result in continued downward trends in ecological integrity. From an integrated standpoint, Alternatives S2 and S3 should be more effective than Alternative S1 in slowing the downward trends and improving ecological integrity (see Figure 4-19).

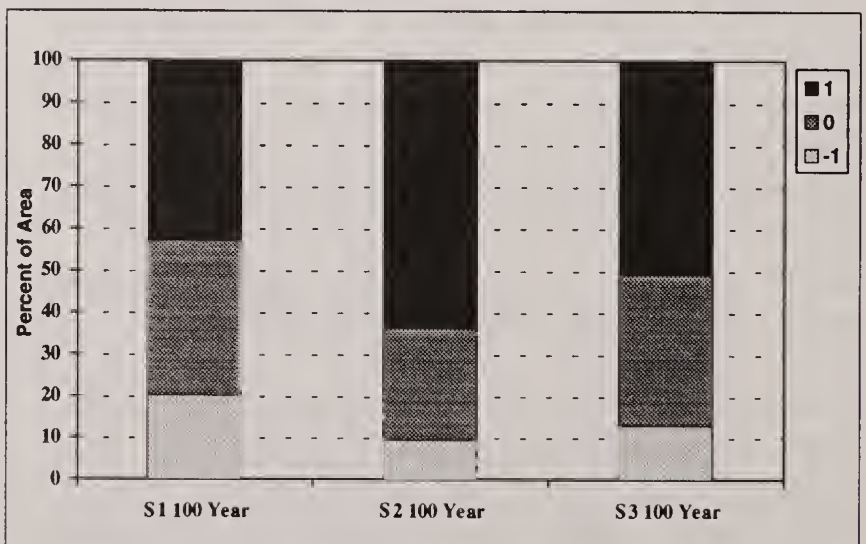


Figure 4-19. Long-term Ecological Integrity Trends, by Alternative, Project Area. Project Area = Forest Service- and BLM-administered Lands.

Map 4-11.
Ecological Integrity Rating Trends

-3

-2

-1

0

1

2

3

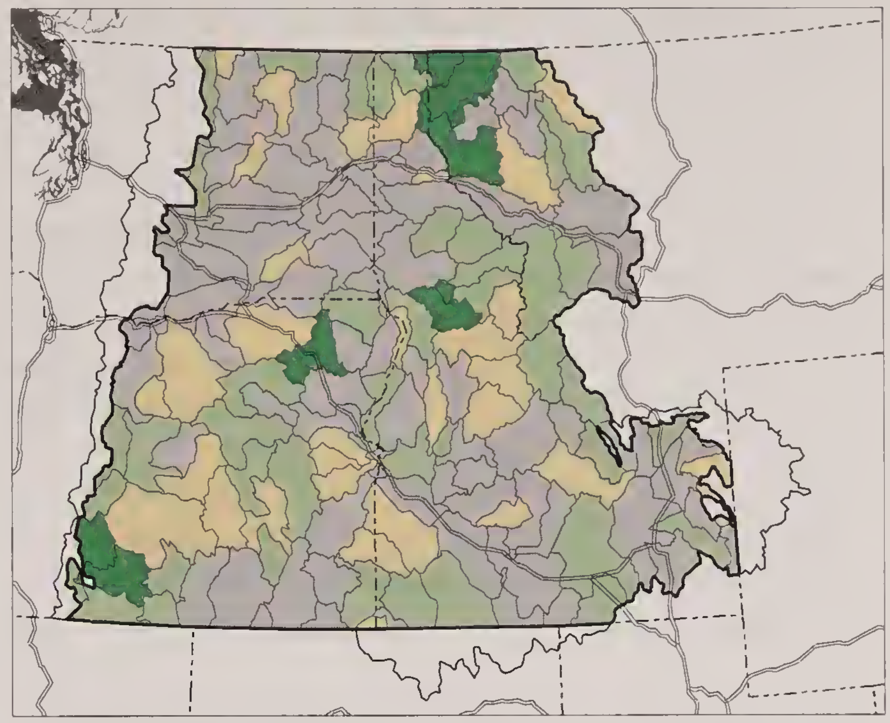
Subbasin Borders

Major Roads

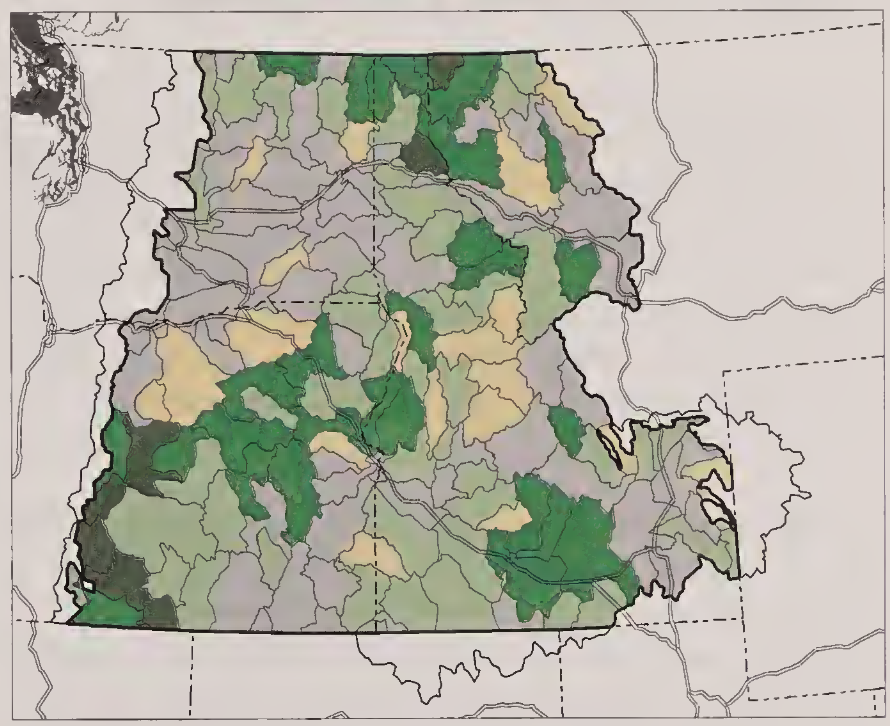
Supplemental Draft EIS Area Border

INTERIOR COLUMBIA
BASIN ECOSYSTEM
MANAGEMENT PROJECT

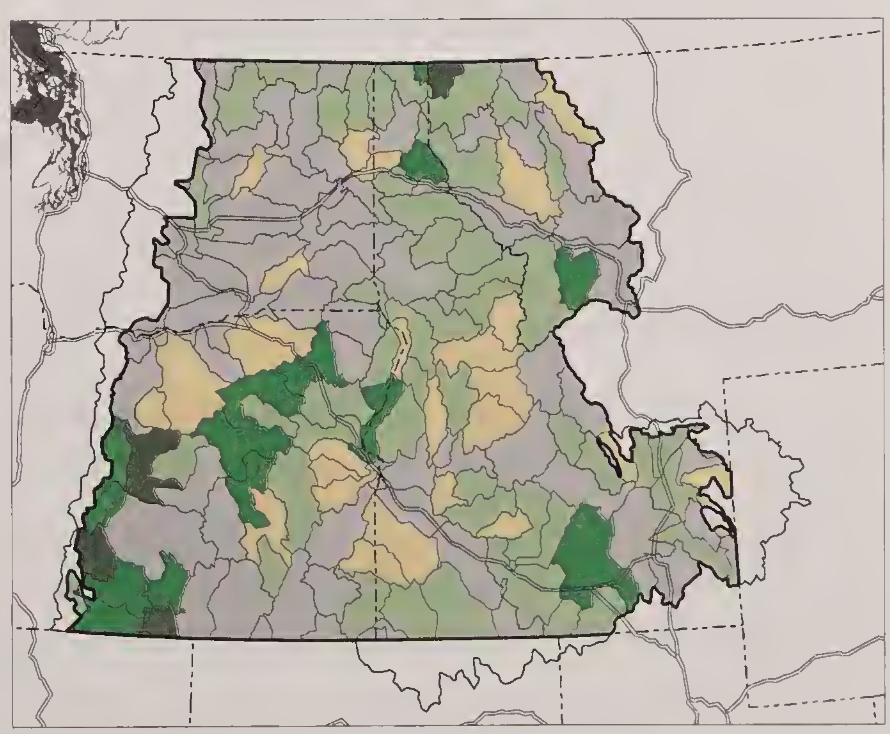
Supplemental Draft EIS Area
2000



Alternative S1



Alternative S2



Alternative S3

The alternatives are quite different in their approach to the management of risk. Alternative S1 attempts to manage risk to important terrestrial and aquatic habitats through more restrictive measures such as Eastside Screens to manage old forests and PACFISH/INFISH standards and guidelines for fish, than do Alternatives S2 and S3 where actions are planned to achieve outcomes. Alternative S1 is based on a short-term risk management strategy of holding on to some of the scarce habitats, while Alternatives S2 and S3 have a more comprehensive short-term strategy (maintain all scarce habitats) but also attempt to bring in a long-term risk management strategy as well (provide a full range of habitats at appropriate scales).

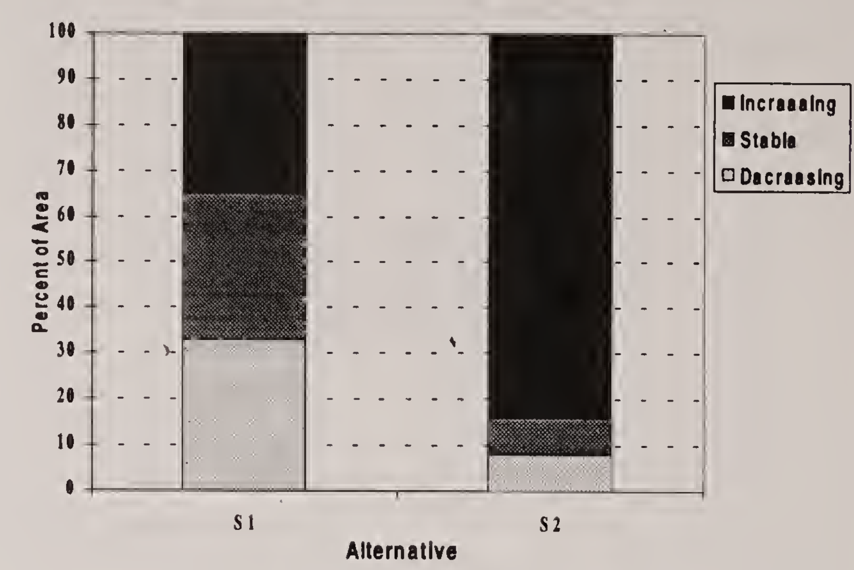


Figure 4-20. Long-term Landscape Health Trends, by Alternative, All Ownerships, Basin-wide.

Landscape Health Trends and Cost Per Unit Area

Landscape health is defined by Hann, Jones, Karl, et al. (1997) as "the best fit of the dynamic interaction of human land use, biodiversity, and ecosystem health that is in balance with the limitations of the biophysical system and inherent disturbance processes...." In their analysis, all of the subwatersheds in the project area currently fall in to the moderate, low, and very low landscape health categories. None are high or very high.

In the long term, projections indicate that Alternative S2 would result in substantially more of the project area with stable and increasing landscape health trends than in Alternative S1. Alternative S3 would fall between Alternatives S2 and S1 (see Figure 4-20). The improvements under Alternative S1 would occur in small scattered patches, while Alternatives S2 and S3 also would show improvements in more concentrated areas that would receive restoration focus (see Map 4-12). In Alternatives S2 and S3, high restoration priority subbasins would show substantial improvements in landscape health over Alternative S1. Alternatives S2 and S3 are expected to move a great majority of the high restoration priority subbasins into the stable or increasing landscape health trends categories (see Figures 4-21 and 4-22).

The average cost-per-unit-area ratio projections show that Alternative S1 would have the highest cost per unit area, with Alternative S2 the lowest cost and Alternative S3 intermediate. Costs would drop lower for Alternatives S2 and S3 in the high restoration priority subbasins.

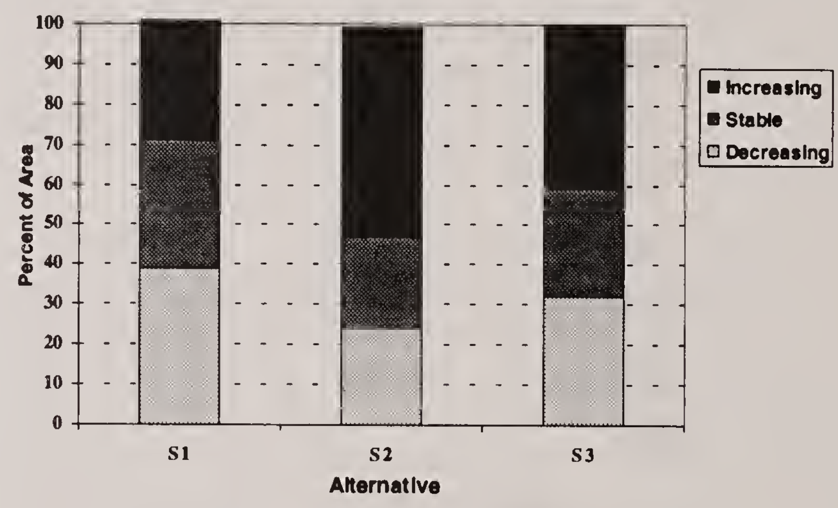


Figure 4-21. Landscape Health in High Restoration Priority Subbasins Alternative S2, Project Area. Project Area = Forest Service- and BLM-administered Lands.

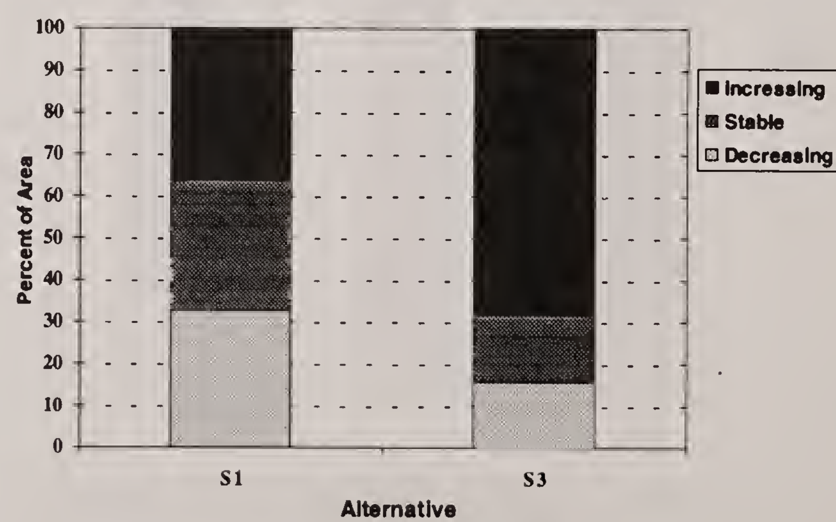


Figure 4-22. Landscape Health in High Restoration Priority Subbasins, Alternative S3, Project Area. Project Area = Forest Service- and BLM-administered Lands.

Map 4-12. Landscape Health Rating Trends

Increasing

Stable

Decreasing

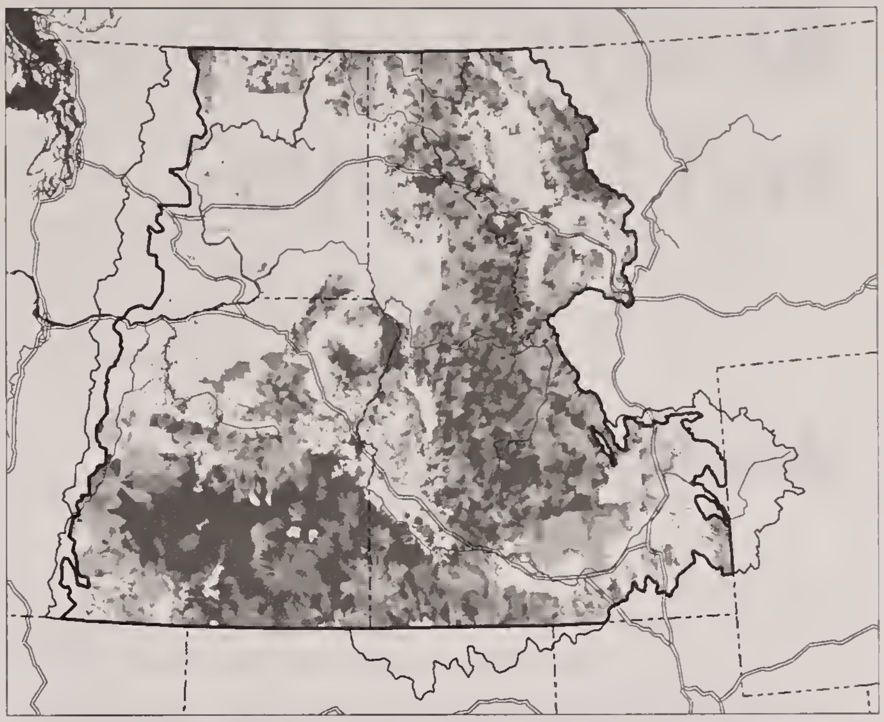
Major Rivers

Major Roads

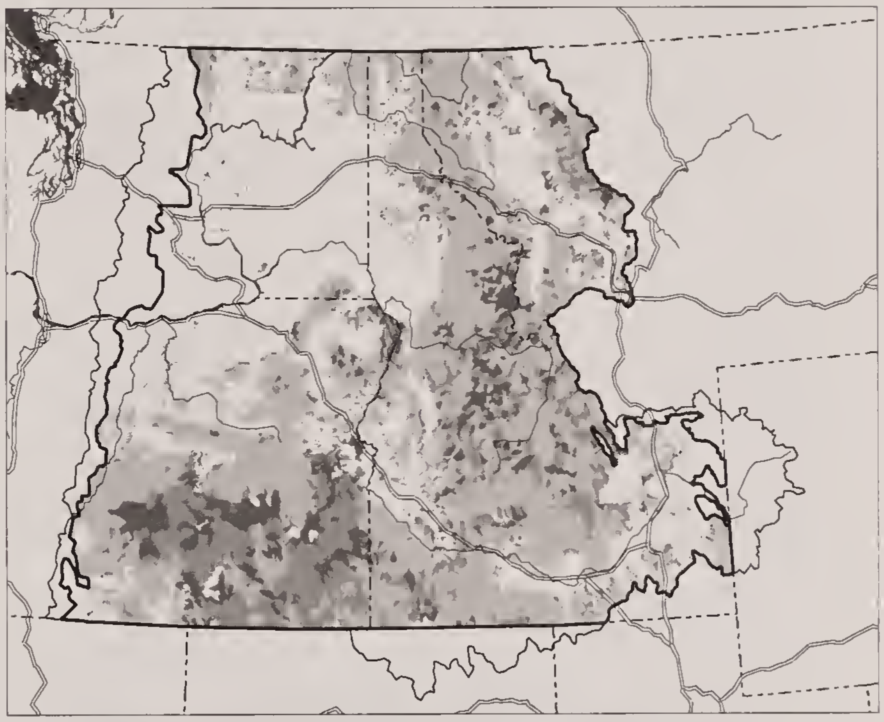
Supplemental Draft EIS Area Border

INTERIOR COLUMBIA BASIN ECOSYSTEM MANAGEMENT PROJECT

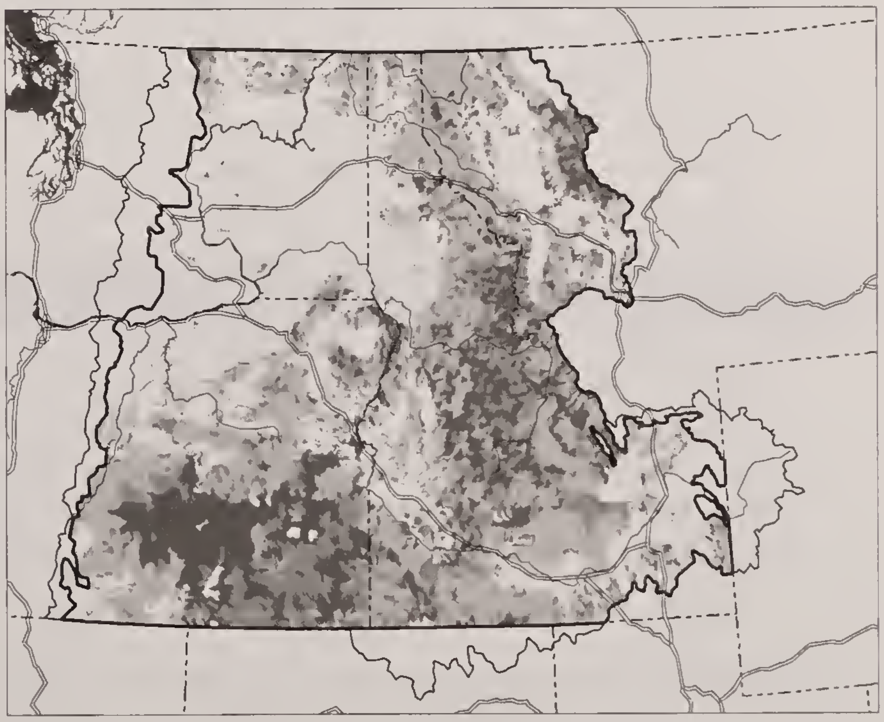
Supplemental Draft EIS Area 2000



Alternative S1



Alternative S2



Alternative S3

Analysis of Implementation Costs and Outputs

Background

This section takes a different look at the three alternatives by approaching them as the budget analysts for the land management agencies might do: describing management activities, potential activity costs, and associated potential outputs at comparable and incremental implementation funding levels. This analysis is distinct from the budget sensitivity analysis, discussed early in this chapter. Tables 4-57, 4-58, 4-59 and 4-60, later in this section, display projected estimates of selected activity costs and associated outputs that would result from the management strategies of the three alternatives.

Implementation of the ICBEMP decision will be financed, as are most land management actions, through federal appropriations from the Congress. As the federal agencies begin to implement the decision, they will request changes in emphasis and funding through the normal appropriations process. They may also work to accomplish work through strategies such as partnerships and volunteers.

Three principles underlie the alternatives:

1. The cost of the alternatives must be realistic with respect to current funding levels for the land management agencies (see sidebar). This was accomplished by providing for a hierarchy of management direction that protects and maintains conditions and then prioritizes restoration to areas where the science findings indicate good opportunities for management actions to be effective.
2. The pace of implementing the alternatives will vary with amount of funding; however, the emphasis and strategies of each alternative would remain the same regardless of the funding level.
3. The selection of the preferred alternative is based on its emphasis and strategies, not on funding levels.

With these principles in mind, the selection of the preferred alternative was based on the management strategies it represents. The Record of Decision will address management direction, not funding levels or funding allocations.

Once a decision is made, the strategy and associated actions called for in the selected alternative will be converted into the budget structure for both the BLM and Forest Service, and the appropriations process will be followed. Administrative units of the BLM and Forest Service will be requesting changes in emphasis and additional capability for all their programs to facilitate implementation of the ICBEMP direction. The management direction of the alternatives is adjustable to variable future funding levels.

Implementation Costs and Outputs Summary

Methodology: How the Implementation Costs and Outputs Summary was Estimated

A team of budget analysts developed the information in Tables 4-57 through 4-60, using standard budget analysis techniques.

The team made assumptions about the amount of overall funding available to undertake the strategies called for in the alternatives. Four levels of funding are assumed in this analysis of implementation costs and outputs. One is the estimated current level of funding, used in the analysis of Alternative S1. This

allows for comparison using a "baseline" condition. In addition, three increased increments of funding were selected by the budget analysts as reasonable increases when compared to the overall budgets for the Forest Service and BLM in the project area. The four levels are:

1. No new funding ($135.0 million total; see Table 4-57);
2. $148.5 million ($13.5 million increase; see Table 4-58);
3. $168.75 million ($33.75 million increase; see Table 4-59);
4. $202 million ($67.0 million increase; see Table 4-60).

Level #4 is comparable to the budget assumption associated with the analysis of Alternative S2, conducted by the SAG (Quigley 1999).

The team identified representative management activities (selected outputs) for display. Through deliberations with policy specialists, the set of variables was determined that represents specific types of restoration activities and their associated outputs. These categories of management activities do not directly correlate to the outcomes identified in other portions of Chapter 4 because they represent a budget analyst's approach to development of future funding proposals and were not generated from the variables modeled by the SAG.

The team identified average total costs for the selected categories of activities across the entire project area, and they used these average costs to estimate activity costs and associated levels of outputs. Costs were estimated using historical budget information on file at the Forest Service and BLM offices at the national, regional, state and national forest/BLM district levels. These estimates will be refined in future budget formulation processes.

The team of budget analysts calibrated the associated levels of outputs to the four selected levels of funding, working from the information available for Alternative S1 (assumed to be funded at the level identified in Table 4-57, no new funding) and Alternative S2 (assumed to be funding at the level in Table 4-60 increased funding). Thus, the alternatives are contrasted at comparable funding levels using the selected management activity variables.

Interpretation of Analysis

To avoid misinterpretation of this analysis the following information is offered:

1. The "employment estimated" figure estimates employment that would result from only 4 of the 12 categories of activities: thinning and harvest, young stand density management, animal unit months (AUMs), and prescribed fire fuel treatments. This category did not estimate jobs that may result from other activities such as those associated with fish habitat improvements or wildlife habitat improvements.
2. The acreage figures for the management activity of prescribed fire/fuel treatments include burning and mechanical fuel reduction. The total treatment area does not always correlate with acres actually burned. For example, an area of 10,000 acres can be treated by prescribed fire restoration activities, but because the management prescription calls for a desired fire intensity that is light or moderate, 500 acres may have been treated mechanically before burning and then only 5,000 acres may actually burn. The resulting mosaic pattern of burned and unburned landscape is generally what is desired.

Changes from the Draft EISs: Implementation Costs

The development of the Supplemental Draft EIS Implementation Costs and Outputs Summary tables reflects a different approach to funding than presented in the Draft EISs. The action alternatives in the Supplemental Draft EIS were designed to " accommodate a range of funding levels so that Congress and the Administration can consider on an annual basis, the costs and benefits of action and inaction and set an appropriate pace for restoration and management" (Babbitt and Glickman 1998). This approach is different from the Draft EISs, where the alternatives were not analyzed at several funding levels. Also, the Draft EISs' analyses were not constrained by funding thresholds; rather, modeled outcomes tended to drive budget needs.

3. The management activities reflect broad categories of funding for both the Forest Service and BLM, and do not directly correlate to the existing budget line items for these agencies.
4. The levels of output for management activities assume 10-year (short-term) averages.
5. None of the management activities have spatial identity; that is, they cannot be spatially located at this point in the analysis and cannot be correlated with specific projects, administrative units, RAC/PAC areas, states, or counties. They are summarized at the project-area-scale only.
6. Implementation of these management activities is guided by the direction of the alternatives and thus by the step-down analysis procedures called for in the alternatives.
7. Consultation and collaboration requirements have a cost and are difficult to estimate. The costs shown here are the costs of collaboration and consultation with states, tribes, and regulatory agencies, in addition to public participation processes, that are additional to the collaboration and consultation processes already in place for the land management agencies.
8. The output of AUMs is an indirect, not direct, result of management direction. Management direction in Alternatives S2 and S3 is not designed to prescribe the levels of AUMs permitted by the Forest Service and BLM in the project area. Rather, it is designed to addressed desired outcomes for landscape health (rangelands, riparian areas, and so on); these desired outcomes mean that there will likely be adjustments in intensity, location, timing, and pattern of domestic livestock grazing. These adjustments could affect total AUMs, but the changes that may result are difficult to predict.
9. Management direction in Alternatives S2 and S3 is not designed to prescribe production levels of volume of timber (board feet) from Forest Service- and BLM-administered lands. Rather, the volume is an output that results from the activities that occur as a result of management direction.

Estimates of the Alternatives' Implementation Costs and Outputs

Tables 4-57, 4-58, 4-59, and 4-60 show the rough, projected implementation cost and output estimates for a select group of management activities at comparable and increasing budget levels. Each table represents a different budget level. A brief summary of the major conclusions from the implementation cost analysis tables is provided at the end of this section.

Alternatives at Different Budget Levels

Tables 4-57 through 4-60 each compare the three alternatives at a consistent level of assumed budget for restoration actions. Each table should be reviewed as a whole. Since the alternatives, especially the action alternatives, are intended to meet integrated ecosystem management objectives and not singular functional objectives, the alternatives should be broadly compared with each other in terms of the multiple activities they achieve and not compared by the singular functional categories of management activities.

No New Funding

With no increases in funding beyond the estimated current level (Table 4-57), outputs associated with the selected categories of management activities would vary among the three alternatives relative to the amount of scarce funds allocated to the management activities to address aquatic and terrestrial wildlife resource issues. Acres of wildlife habitat improvement would double, for example, in Alternatives S2 and S3 compared to Alternative S1. Prescribed fire

Table 57. ICBEMP Implementation Costs and Outputs Summary for Alternatives S1, S2, and S3 Selected Management Activities Assuming No New Funding (Total, BLM- and Forest Service-administered Lands).

Management Activity[1]	Alternative S1[2] ($000s)	Alternative S2 ($000s)	Alternative S3 ($000s)	Alternative S1 Outputs	Alternative S2 Outputs	Alternative S3 Outputs
Thinning and harvest	$54,540	$54,827	$53,423	814 MMBF	818 MMBF	797 MMBF
Young stand density management	$17,077	$18,802	$18,883	211 Macres	232 Macres	233 Macres
Prescribed fire/fuel treatment	$19,370	$23,333	$23,498	483 Macres	730 Macres	734 Macres
Watershed/riparian restoration	$6,853	$9,777	$9,447	22 Macres	33 Macres	31 Macres
Road treatments	$3,520	$3,815	$3,688	620 miles	671 miles	650 miles
Weeds management	$4,945	$5,210	$5,116	165 Macres	174 Macres	170 Macres
Domestic livestock grazing	$3,111	$4,578	$4,224	3,129 MAUMs	2,814 MAUMs	2,781 MAUMs
Rangeland improvements	$1,239	$1,276	$1,190	25 Macres	25 Macres	24 Macres
Fish habitat improvements	$4,598	$4,829	$4,640	511 miles	537 miles	515 miles
Wildlife habitat improvements	$1,747	$3,553	3,391	40 Macres	81 Macres	77 Macres
Total, Management Activities	$117,000	$130,000	$127,500			
Total, Analysis/Collaboration[3]	$18,000	$5,000	$7,500			
Total, No New Funds[4]	$135,000	$135,000	$135,000			
Employment Estimates[5]				8,426 jobs	8,484 jobs	8,313 jobs

Abbreviations used in this table:
ICBEMP - Interior Columbia Basin Ecosystem Management Project
BLM - Bureau of Land Management
MMBF - Million board feet
Macres - Thousand acres
MAUMs - Thousand AUMs (Animal Unit Months)

[1] Management activities are a representative sample of outputs that are reasonably expected from management strategies in the alternatives. These categories of activities approximate those that have been used by the land management agencies in development of programs of work.
[2] This level of funding is what the Science Advisory Group assumed in modeling this alternative.
[3] Collaboration and consultation includes the efforts made to work with states, tribes and regulatory agencies, in addition to the public participation processes that are already in place and in use by the agencies.
[4] This total approximates those funds available to the land management agencies for accomplishment of the restoration actions described in this table.
[5] Employment estimates rounded to the nearest 100 jobs. Employment is estimated for 4 of the 12 management activities: thinning and harvest, young stand density management, prescribed fire, and AUMs.

Table 58. ICBEMP Implementation Costs and Outputs Summary for Alternatives S1, S2, and S3 Selected Management Activities Assuming + $13.5 Million over Current Funding (Total, BLM- and Forest Service-administered Lands).

Management Activity[1]	Alternative S1 ($000s)	Alternative S2 ($000s)	Alternative S3 ($000s)	Alternative S1 Outputs	Alternative S2 Outputs	Alternative S3 Outputs
Thinning and harvest	$61,757	$57,581	$56,711	922 MMBF	859 MMBF	846 MMBF
Young stand density management	$18,782	$19,666	$19,830	231 Macres	242 Macres	244 Macres
Prescribed fire/fuel treatment	$21,303	$29,190	$29,531	665 Macres	912 Macres	923 Macres
Watershed/riparian restoration	$7,562	$9,746	$9,490	24 Macres	31 Macres	31 Macres
Road treatments	$3,896	$4,249	$4,151	618 miles	748 miles	731 miles
Weeds management	$5,438	$6,035	$5,960	181 Macres	201 Macres	198 Macres
Domestic livestock grazing	$3,422	$4,495	$4,338	3,129 MAUMs	2,814 MAUMs	2,781 MAUMs
Rangeland improvements	$1,362	$1,695	$1,627	27 Macres	34Macres	32 Macres
Fish habitat improvements	$5,056	$5,536	$5,389	561 miles	615 miles	599 miles
Wildlife habitat improvements	$1,922	$3,695	3,570	44 Macres	84 Macres	81 Macres
Total, Management Activities	$130,500	$141,888	$140,597			
Total, Analysis/Collaboration[2]	$18,000	$6,612	$7,903			
Total Funds	$148,500	$148,500	$148,500			
Employment Estimates[3]				9,360 jobs	8,989 jobs	8,882 jobs

Abbreviations used in this table:
ICBEMP - Interior Columbia Basin Ecosystem Management Project
BLM - Bureau of Land Management
MMBF - Million board feet
Macres - Thousand acres
MAUMs - Thousand AUMs (Animal Unit Months)

[1] Management activities are a representative sample of outputs that are reasonably expected from management strategies in the alternatives. These categories of activities approximate those that have been used by the land management agencies in development of programs of work.

[2] Collaboration and consultation includes the efforts made to work with states, tribes, and regulatory agencies, in addition to the public participation processes that are already in place and in use by the agencies.

[3] Employment estimates rounded to the nearest 100 jobs. Employment is estimated for 4 of the 12 management activities: thinning and harvest, young stand density management, prescribed fire, and AUMs.

Table 4-59. ICBEMP Implementation Costs and Outputs Summary for Alternatives S1, S2, and S3 Select Management Activities Assuming + $33.75 Million over Current Funding (Total, BLM- and Forest Service-administered Lands).

Management Activity[1]	Alternative S1 ($000s)	Alternative S2 ($000s)	Alternative S3[2] ($000s)	Alternative S1 Outputs	Alternative S2 Outputs	Alternative S3 Outputs
Thinning and harvest	$71,387	$60,403	$60,370	1,065 MMBF	901 MMBF	901 MMBF
Young stand density management	$21,699	$21,347	$21,640	268 Macres	263 Macres	267 Macres
Prescribed tire/tuel treatment	$24,612	$38,251	$38,863	769 Macres	1,195 Macres	1,214 Macres
Watershed/riparian restoration	$8,708	$9,924	$9,768	28 Macres	32 Macres	32 Macres
Road treatments	$4,472	$4,969	$4,909	787 miles	874 miles	863 miles
Weeds management	$6,283	$7,354	$7,309	209 Macres	245 Macres	244 Macres
Domestic livestock grazing	$3,952	$4,479	$4,599	3,129 MAUMs	2,814 MAUMs	2,781 MAUMs
Rangeland improvements	$1,574	$2,334	$2,293	32 Macres	47 Macres	46 Macres
Fish habitat improvements	$5,842	$6,676	$6,586	649 miles	741 miles	959 miles
Wildlife habitat improvements	$2,221	$3,984	$3,906	50 Macres	90 Macres	87 Macres
Total, Management Activities	$150,750	$159,721	$160,243			
Total, Analysis/Collaboration[3]	$18,000	$9,029	$8,507			
Total Funds	$168,750	$168,750	$168,750			
Employment Estimates[4]				10,639 jobs	9,607 jobs	9,614 jobs

Abbreviations used in this table:
ICBEMP - Interior Columbia Basin Ecosystem Management Project
BLM - Bureau of Land Management
MMBF - Million board feet
Macres - Thousand acres
MAUMs - Thousand AUMs (Animal Unit Months)

[1] Management activities are a representative sample of outputs that are reasonably expected from management strategies in the alternatives. These categories of activities approximate those that have been used by the land management agencies in development of programs of work.
[2] The level of funding the Science Advisory Group assumed in modeling Alternative S3 was approximately $47.0 million, $13.25 million more than this budget scenario.
[3] Collaboration and consultation includes the efforts made to work with states, tribes, and regulatory agencies, in addition to the public participation processes that are already in place and in use by the agencies.
[4] Employment estimates rounded to the nearest 100 jobs. Employment is estimated for 4 of the 12 management activities: thinning and harvest, young stand density management, prescribed fire, and AUMs.

Table 4-60. ICBEMP Implementation Costs and Outputs Summary for Alternatives S1, S2 and S3 Selected Management Activities Assuming + $67 Million over Current Funding (Total, BLM- and Forest Service-administered Lands).

Management Activity[1]	Alternative S1 ($000s)	Alternative S2[2] ($000s)	Alternative S3 ($000s)	Alternative S1 Outputs	Alternative S2 Outputs	Alternative S3 Outputs
Thinning and harvest	$88,495	$66,059	$67,416	1,380 MMBF	986 MMBF	1,006 MMBF
Young stand density management	$26,112	$24,001	$24,502	322 Macres	296 Macres	302 Macres
Prescribed fire/fuel treatment	$29,619	$52,500	$53,570	925 Macres	1,465 Macres	1,503 Macres
Watershed/riparian restoration	$10,479	$10,207	$10,210	34 Macres	33 Macres	33 Macres
Road treatments	$5,381	$6,102	$6,104	947 miles	1,074 miles	1,074 miles
Weeds management	$7,561	$9,429	$9,433	252 Macres	314 Macres	314 Macres
Domestic livestock grazing	$4,756	$4,455	$5,012	3,129 MAUMs	2,814 MAUMs	2,781 MAUMs
Rangeland improvements	$1,895	$3,339	$3,340	37 Macres	67 Macres	67 Macres
Fish habitat improvements	$7,031	$8,470	$8,474	781 miles	941 miles	941 miles
Wildlife habitat improvements	$2,671	$4,438	$4,439	60 Macres	100 Macres	100 Macres
Total, Management Activities	$184,000	$189,000	$192,500			
Total, Analysis/Collaboration[3]	$18,000	$13,000	$9,500			
Total Funds	$202,000	$202,000	$202,000			
Employment Estimates[4]				13,335 jobs	10,731 jobs	10,913 jobs

Abbreviations used in this table:
ICBEMP - Interior Columbia Basin Ecosystem Management Project
BLM - Bureau of Land Management
MMBF - Million board feet
Macres - Thousand acres
MAUMs - Thousand AUMs (Animal Unit Months)

[1] Management activities are a representative sample of outputs that are reasonably expected from management strategies in the alternatives. These categories of activities approximate those that have been used by the land management agencies in development of programs of work.
[2] Approximates the outputs and funding level as modeled by Science Advisory Group for this alternative only.
[3] Collaboration and consultation includes the efforts made to work with states, tribes and regulatory agencies, in addition to the public participation processes that are already in place and in use by the agencies.
[4] Employment estimates rounded to the nearest 100 jobs. Employment is estimated for 4 of the 12 management activities: thinning and harvest, young stand density management, prescribed fire, and AUMs.

and fuel treatment acres also would increase for Alternatives S2 and S3, reflecting the themes of activities that focus on restoration of landscape disturbance patterns. Thinning and restoration timber harvest also would increase slightly for Alternatives S2 and S3, although harvest would be focused on smaller trees with less volume per unit. Acres treated for noxious weeds would increase slightly. In summary, the focus of the action alternatives on maintenance and restoration of aquatic and terrestrial habitats and sustainable landscape dynamics require more restoration management actions and consequent outputs in those categories of actions under Alternatives S2 and S3 compared to Alternative S1, even at no increased funding.

These cost and output estimates do not adequately acknowledge the prioritization strategies of the action alternatives. Even at current funding levels, Alternatives S2 and S3 are designed such that restoration funds would be targeted toward areas identified as restoration priorities, thereby maximizing the efficient and effective expenditure of fiscal resources. Restoration priorities were determined, in part, based on the risk to resource values and the opportunity for management actions to "make a difference." The budget analysts who developed these tables did not calibrate the per-unit costs to account for the enhanced effectiveness and efficiencies of the design embedded in the action alternatives. Since the same per-unit costs are used for all three alternatives, the outputs are probably underestimated for Alternatives S2 and S3 at current funding levels.

$13.5 Million Over Current Funding

The outputs associated with the selected categories of management activities would increase proportionately with increased funding to $13.5 million over current funding (Table 4-58), because in this rough analysis the per-unit costs would stay relatively the same between alternatives. As a result, the cost and output estimates do not adequately acknowledge the prioritization strategies of the action alternatives. The new funding available in Alternative S1 would be distributed throughout the project area using existing mechanisms for determining priority (existing land use plans, regional and state priorities, and so on). New funding for the action alternatives would be focused on and allocated to high restoration priority areas (high risk and high opportunity).

Alternative S1, with increased funding, follows a pattern of funding allocation more typical of the existing 62 individual forest and land use plans. Thinning and harvest volumes would increase at a higher rate than Alternatives S2 and S3 because of these more traditional management themes and because of the lack of a comprehensive and focused strategy to guide restoration activities. These projected levels of activity account for the increase in employment simply because employment is calculated based on only four of the categories of management activities. Other employment opportunities are associated with fish and wildlife habitat improvements, for example, but this analysis was not able to calculate them.

As discussed above, management direction in the action alternatives is not designed to address the level of permitted AUMs; rather, it is designed to addressed desired outcomes for landscape health. To achieve the desired outcomes means likely adjustments in intensity, location, timing, and pattern of domestic livestock grazing. These adjustments could affect AUMs, but that relationship is difficult to predict. Nonetheless, the increased funds invested in the category of rangeland improvements and grazing (associated with livestock grazing) would increase the amount of activity in the categories, while the associated outputs (AUMs or rangeland improvement acres), would stay the same as presented with "no additional funding" in the Table 4-57. With increased funding, there would be direct increases in prescribed fire treatments in Alternative S1, but not to the extent of the increases for the action alternatives, where the focus of the alternatives is on using prescribed fire and fuel treatments to restore vegetation disturbance patterns and processes.

$33.75 Million Over Current Funding

Continuing the trend, the outputs associated with the selected categories of management activities would increase in proportion to the allocations of increased funding to $33.75 million over current funding (Table 4-59), because in this rough analysis the per-unit costs would stay relatively the same between alternatives. As described above, the cost and output estimates do not adequately acknowledge the prioritization strategies of the action alternatives. The new funding available in Alternative S1 would be distributed

throughout the project area using existing allocation mechanisms for determining priority (existing land management plans, regional and state priorities, and so on). New funding for the action alternatives would be focused on and allocated to high restoration priority areas (high risk and high opportunity).

Management activities intended to produce integrated landscape improvements and treatments for wildlife, fisheries, roads, watersheds, and riparian habitats would continue to increase steadily with additional funding. Levels of activities associated with thinning and harvest also would increase, as a result of restoration activities occurring in forested landscapes. Given the less integrated, less restorative theme of Alternative S1, there would be a greater increase in thinning and harvest than in the action alternatives and, as already demonstrated, the projected increased volumes directly correlate with anticipated employment opportunities. Finally, the same caveat relative to livestock grazing is relevant—the intent of the management direction is to focus on grazing systems intended to achieve desired outcomes. Management direction does not prescribe levels of AUMs.

$67.0 Million Over Current Funding

The pattern of increases in implementation costs and associated outputs would continue at $67.0 million over current funding (Table 4-60) and is consistent with the descriptions provided above. Harvest volumes from thinning and harvest are anticipated to continue to increase under existing land use plans in Alternative S1 if additional funding were available. The caveat is that other factors, not well integrated in Alternative S1, are expected to make these projections difficult to achieve. Alternatives S2 and S3 would generate noticeable increases in outputs for restoration activities and improvements such as road treatments, fish improvements, wildlife improvements, and treatment of noxious weeds. Alternative S3 would provide for slightly more activities and jobs than Alternative S2 since it was designed to more rapidly move to restoration actions with less attention paid to up-front analyses.

Implementation Cost Summary

The integrated strategies of the action alternatives would distribute the available budgets to restoration activities with more of an emphasis on addressing a broad suite of ecosystem management issues. At any given budget, the action alternatives would ensure that the strategies can be achieved through the hierarchy of direction and the prioritization of restoration investment to places where risk and opportunity are high. Increased funding to Alternative S1 would generate additional outputs, consistent with existing land use plan directions and allocations.

Chapter 5

Preparation, Consultation, and Coordination

Contents

List of Preparers

This Supplemental Draft Environmental Impact Statement (SDEIS) was prepared by an interdisciplinary team of specialists for the Interior Columbia Basin Ecosystem Management Project (ICBEMP). The following lists project managers, EIS Team members, and other agency contributors to the EIS (current as of September 1999). These lists are followed by agencies and organizations who provided comments or information during its preparation, all of whom will receive a copy of this document, individuals are not included. Any omissions or errors are unintended.

Project Management Team

Susan Giannettino Project Manager Boise, Idaho	Ph.C., Anthropology, Univeristy of Washington M.A., Anthropology, University of Washington B.A., Anthropology and History, University of Montana Forest Service (24 years)	Experience includes positions as Social Scientist, Public Affairs Officer, Planning Staff Officer, Acting Forest Supervisor, District Ranger, Regional Recreation Strategy Coordinator, Deputy Forest Supervisor, and Forest Supervisor.
Geoffrey Middaugh Deputy Project Manager Walla Walla, Washington	M.S., Natural Resources Utah State University B.S., Forestry University of Missouri Bureau of Land Management (28 years)	Experience includes positions as Associate District Manager, Program Analyst, Budget Officer, Multi-Resource Chief, and Outdoor Recreation Planner.
Thomas Quigley Science Advisory Group Leader La Grande, Oregon	Ph.D., Range Economics, Colorado State University M.S., Range Economics, Utah State University B.S., Watershed Science, Utah State University Forest Service (23 years)	Experience includes positions as Managing Natural Disturbances to Sustain Forest Health Program Manager, Hydrologist, Range Conservationist, Blue Mountain Natural Resources Institute Manager.

EIS Team Members

Jeff Walter EIS Team Leader Boise, Idaho	B.S., Forest Management, Colorado State University Forest Service (23 years)	Experience includes positions as Project Leader for Watershed Analysis, Resources Management Assistant, GIS Coordinator, Silviculturist, Forester.
Cathy Humphrey Deputy EIS Team Leader Walla Walla, Washington	B.S., Geological Sciences, New Mexico State University Bureau of Land Management (18 years)	Experience includes positions as Planning Team Leader, Wild and Scenic River Team Leader, and Petroleum Geologist.
Mary Carr Technical Writer-Editor	M.S., Biology, University of New Hampshire B.A., English, Worcester State College Forest Service (7 years) Private Non-Profit Organizations (12 years) Freelance Technical Editor (4 years)	Experience includes positions as Writer-Editor, Communications Director, Science Writer, and Technical Editor; published author.
Patricia Carroll Hydrologist and Soil Scientist (until May 1999)	B.S., Soil and Water Conservation, University of California at Berkeley Forest Service (15 years) U.S. Geological Survey (3 years)	Experience includes positions as Supervisory Hydrologist, and Hydrologist; and positions in erosion control, groundwater studies, and hydropower projects.
Hal Gibbs Wildlife Biologist	M.S., Wildlife Biology, Colorado State University B.S., Wildlife Science, New Mexico State University Forest Service (22 years)	Experience includes positions as District Ranger, Forest Biologist, Resource Assistant, and District Biologist.
Terry Hardy Hydrologist	B.S. Soil Science, Montana State University Forest Service (14 years)	Experience includes positions as Hydrologist at Forest and District levels and positions in mined land reclamation, watershed, and anadromous fisheries habitat restoration.

EIS Team Members (continued)

Michael ("Sherm") Karl Rangeland Management Specialist and Ecologist	Ph.D., Rangeland Resources, Oregon State University M.S., Zoology, with emphasis in Range Management Fort Hays State University A.B., Biology, Ripon College BLM (1 year) Forest Service (4years) Agricultural Research Service (3 years)	Experience includes positions as Rangeland Scientist, Rangeland Management Specialist, and Ecologist.
Steven Kozel Aquatic Ecologist	M.S., Zoology and Physiology, University of Wyoming B.S., Wildlife and Fisheries, South Dakota State University Forest Service (12 years)	Experience includes positions as Anadromous Fish Coordinator, Forest Fishery Biologist, Zone Fishery Biologist, and Fishery Biologist.
Thomas Miles Rangeland Management Specialist	B.S., Wildlife Management with Range Management emphasis, Humbolt State University Bureau of Land Management (19 years)	Experience includes positions as Supervisory Range Conservationist, Range Conservationist, and Range Technician.
Chris Hansen-Murray Economist	M.A., Political Science, University of Colorado B.A., Political Science, University of Colorado Forest Service (19 years) National Park Service (4 years) Seattle City Light (3 years)	Experiences includes positions as Economist and Administrative Officer.
Jerry Perez Writer-Editor (until January 1999)	B.S., Forest Resources Management, West Virginia University Forest Service (8 years) U.S. Peace Corps (2 years)	Experience includes positions as Writer-Editor, Public Affairs Specialist, Appeals and Litigation Specialist, Environmental Coordinator and Forester.
Richard Phillips Economist	B.S. Forest Science Colorado State University Forest Service (20 years) U.S. Peace Corps (2 years)	Experience includes positions as Forest Economist, Operations Research Planner, and Forest Management Researcher.
Nick Reyna Economist (until February 1999)	M.S., Forest Planning Administration, Oregon State University B.S., Forest Management, Oregon State University Forest Service (19 years)	Experience includes positions as Economics Researcher, Policy Analyst, Forest Economist, Transportation Planner, Planning Forester, and Timber Forester.

EIS Team Members (continued)

John Sloan Forest Ecologist	M.S., Forest Ecology, University of Minnesota B.A., Biology, Wartburg College Forest Service (13 years) U.S. Peace Corps (2 years)	Experience includes positions as Research Forester and Forestry/Soil Conservation Officer.
Joan Suther Wildlife Biologist (until January 1999)	B.A., Biology, Humbolt State Univeristy Forest Service (8 years) Bureau of Land Management (3 years)	Experience includes positions as Resource Officer, District Ranger, Supervisory Wildlife Biologist, Fisheries Technician.
Peter Teensma Fire Ecologist	Ph.D., Geography, University of Oregon M.A., Geography, University of Oregon B.A., Geography, University of California, Los Angeles Bureau of Land Management/Forest Service Joint Position (5 years) Bureau of Land Management (5 years) Forest Service (4 years)	Experience includes positions as Fire Ecologist, NW Forest Plan EIS Team, Fire Planner, Forest Modeling Specialist, Prescribed Fire Specialist, Incident Management Team Member, and Interagency Hotshot Crew Member.
Cliff Walker Tribal Liaison	Forest Service	
Shari Whitwell Computer Specialist	Boise State University Forest Service (4 years) Bureau of Land Management (4 years)	Experience includes Computer Specialist, Computer Clerk, and Office Automation Clerk.
Gary Wyke Land Use Planner	M.S., Wildland Resource Science, University of California B.S., Forestry, University of California Bureau of Land Management (26 years)	Experience includes positions as Planning Coordinator, NEPA Coordinator, Branch Chief for Planning and Resources, and Range Conservationist.
Cheryle Zwang Tribal Liaison	Bureau of Land Management	

Administrative Support

Deanna Mendiola	Forest Service, Administration Team Leader
LaVerne Scott	Forest Service, Deputy Administration Team Leader
Theresa Berry	Forest Service, Office Automation Assistant (until March 1999)
Diana Darby	Forest Service, Computer Systems Support (until April 1998)
Cindy Dean	Forest Service, Freedom of Information Act/Records Coordinator
Jodi Ferguson	Forest Service, Office Automation Assistant
Michelle Ferguson	Forest Service, Office Automation Assistant
Diana Gilbert	Forest Service, Office Automation Assistant (until December 1997)
Connie Gilbreath	Forest Service, Administrative Support
Becky Jenison	Forest Service, Administrative Support (until November 1998)
Lisa Kulisek	Bureau of Land Management, Office Automation Assistant
Cindy Martindale	Forest Service, Office Automation Assistant (until August 1999)
Dan Mayer	Forest Service, Purchasing Agent
Eloisa Munden	Bureau of Land Management, Office Automation Assistant (until September 1997)
Nancy Reif	Forest Service, Office Automation Assistant
John Zodnick	Forest Service, Computer Systems Analyst

Document Production

Diana Baxter	Forest Service, Public Affairs Specialist (June 1999)
Susan Bond	Bureau of Land Management, Document Layout (February 2000)
Kathy Campbell	Forest Service, Public Affairs Specialist
Jodi Clifford	Bureau of Land Management, Writer-editor
Jodi Ferguson	Forest Service, Office Automation Assistant
Venetia Gempler	Forest Service, Public Affairs Specialist
Donna Kreiensieck	Bureau of Land Management, Staff Assistant
Lisa Kulisek	Bureau of Land Management, Office Automation Assistant
Cliff McClelland	Bureau of Land Management, Printing Specialist
Deana Parrish	Bureau of Indian Affairs, Editorial Assistant
Alison Preszler	Forest Service, Graphic Design (July-September 1999)
Karen Terrazas	Office Automation Assistant (July-September 1999)
Shari Whitwell	Bureau of Land Management, Computer Specialist

Communications Team

Andy Brunelle	Forest Service, Communications Team Leader
Rex Holloway	Forest Service, Deputy Communications Team Leader (until February 1999)
Brenda Lincoln	Bureau of Land Management, Deputy Communications Team Leader (from March 1999)
Kathy Campbell	Forest Service, Public Affairs Specialist
Heidi Bigler Cole	Forest Service, Public Affairs Specialist (until December 1997)
Venetia Gempler	Forest Service, Public Affairs Specialist
Jerry Perez	Forest Service, Public Affairs Specialist (until January 1999)
Kathy Peterson	Forest Service, Writer/Editor, Public Affairs Specialist (March - July 1999)
Sue Tholen	Bureau of Land Management, Public Affairs Specialist
Jimmye Turner	Forest Service, Leading Edge (January - February 1999)

Geographic Information System/Spatial Analysis Team

Rebecca Gravenmier	Team Leader, Bureau of Land Management, Oregon/Washington State Office
John Bagdanoff	Database Support, AverStar, Inc. on contract to Bureau of Land Management (until April 1998)
Greg Bell	GIS Support, AverStar, Inc. on contract to Bureau of Land Management
James Blatt	GIS Support, AverStar, Inc. on contract to Bureau of Land Management
Greg Chan	Database Support, AverStar, Inc. on contract to Bureau of Land Management
Thang Lam	GIS/Homepage Support, AverStar, Inc. on contract to Bureau of Land Management
Terry Locke	Database Support, AverStar, Inc. on contract to Bureau of Land Management
Cary Lorimor	GIS Analyst, Pacific Meridian Resources, on contract to United States Forest Service
Carolyn McCarthy	GIS Support, AverStar, Inc. on contract to Bureau of Land Management
Arthur Miller	GIS Support, AverStar, Inc. on contract to Bureau of Land Management
Laurie Riley	GIS/Data Support, AverStar, Inc. on contract to Bureau of Land Management
Nupur Shankar	GIS Support, AverStar, Inc. on contract to Bureau of Land Management
Bart Sunseri	Database Support, AverStar, Inc. on contract to Bureau of Land Management
Tuyen Ta	GIS Support, AverStar, Inc. on contract to Bureau of Land Management
Ann Marie Walker	GIS Support, AverStar, Inc. on contract to Bureau of Land Management

Science Advisory Group

Thomas Quigley, Science Advisory Group Leader
Forest Service, Pacific Northwest Research Station, Forestry Sciences Laboratory, La Grande, Oregon

Rebecca Gravenmier, Science Coordinator
Bureau of Land Management, Oregon/Washington State Office, Portland, Oregon

Aquatics

Bruce Rieman, Research Fisheries Biologist, Co-Team Leader
Forest Service, Rocky Mountain Research Station, Forestry Sciences Laboratory, Boise, Idaho

James Sedell, Principal Research Ecologist, Co-Team Leader
Forest Service, Inter-deputy Water Coordinator, Washington D.C.

Alan Barta, Research Geomorphologist
Forest Service, Rocky Mountain Research Station, Forestry Sciences Laboratory, Boise, Idaho

Gwynne Chandler, Aquatic GIS Support
Forest Service, Rocky Mountain Research Station, Forestry Sciences Laboratory, Boise, Idaho

Jim Clayton, Research Soil Scientist
Forest Service, Rocky Mountain Research Station, Forestry Sciences Laboratory, Boise, Idaho

Phil Howell, Fisheries Biologist
Forest Service, Pacific Northwest Research Station, Forestry Sciences Laboratory, La Grande, Oregon

Jack King, Research Hydrologist
Forest Service, Rocky Mountain Research Station, Forestry Sciences Laboratory, Boise, Idaho

Danny Lee, Aquatic Ecologist
Forest Service, Sierra Nevada Conservation Framework, Sacramento, California

Debby Myers, Aquatic GIS Support
Forest Service, Rocky Mountain Research Station, Forestry Sciences Laboratory, Boise, Idaho

Kerry Overton, Fisheries Biologist
Forest Service, Rocky Mountain Research Station, Forestry Sciences Laboratory, Boise, Idaho

Sharon Parks, Aquatic GIS Support
Forest Service, Rocky Mountain Research Station, Forestry Sciences Laboratory, Boise, Idaho

Jim Peterson, Research Biologist
Forest Service, Rocky Mountain Research Station, Forestry Sciences Laboratory, Boise, Idaho

Bill Thompson, Research Biologist
Forest Service, Rocky Mountain Research Station, Forestry Sciences Laboratory, Boise, Idaho

Russell Thurow, Fisheries Research Scientist
Forest Service, Rocky Mountain Research Station, Forestry Sciences Laboratory, Boise, Idaho

Economics/Social

Richard Haynes, Research Forester, Team Leader
Forest Service, Pacific Northwest Research Station, Forestry Sciences Laboratory, Portland, Oregon

Lisa Crone, Forest Economist
Forest Service, Pacific Northwest Research Station, Walla Walla, Washington (until August 1999)

Landscape Ecology

Rebecca Gravenmier, Co-Team Leader
Bureau of Land Management, Oregon/Washington State Office, Portland, Oregon

Wendel Hann, National Landscape Ecologist, Co-Team Leader
Forest Service, Washington Office, Silverthorne, Colorado

Miles Hemstrom, Landscape Ecologist
Forest Service, Pacific Northwest Research Station, Portland, Oregon

Jerry Korol, Landscape Ecologist
Forest Service, Pacific Northwest Research Station, Walla Walla, Washington

Terrestrial

Martin Raphael, Chief Research Wildlife Ecologist, Team Leader
Forest Service, Pacific Northwest Research Station, Forestry Sciences Laboratory, Olympia, Washington

Lisa Croft, Plant Ecologist
Forest Service, Ochoco National Forest, Prineville, Oregon

Richard Holthausen, Wildlife Ecologist
Forest Service, Rocky Mountain Research Station, Southwest Forest Science Complex, Flagstaff, Arizona

John Kie, Wildlife Biologist
Forest Service, Pacific Northwest Research Station, Forestry Sciences Laboratory, La Grande, Oregon

John Lehmkuhl, Wildlife Ecologist
Forest Service, Pacific Northwest Research Station, Forestry Sciences Laboratory, Wenatchee, Washington

Bruce Marcot, Wildlife Ecologist
Forest Service, Pacific Northwest Research Station, Forestry Sciences Laboratory, Portland, Oregon

Wayne Owen, Botanist
Forest Service, Southern Region, Atlanta, Georgia

Terry Rich, Nongame Bird Program Manager
Bureau of Land Management, Washington Office, Boise, Idaho

Mary Rowland, Wildlife Biologist
Bureau of Land Management, Oregon/Washington State Office, La Grande, Oregon

Victoria Saab, Research Wildlife Biologist
Forest Service, Rocky Mountain Research Station, Forestry Sciences Laboratory, Boise, Idaho

Barbara Wales, Wildlife Biologist
Forest Service, Pacific Northwest Research Station, Forestry Sciences Laboratory, La Grande, Oregon

Michael Wisdom, Wildlife Biologist
Forest Service, Pacific Northwest Research Station, Forestry Sciences Laboratory, La Grande, Oregon

Other Contributors

Jeff Blackwood	Project Manager, Walla Walla, Washington, November 1993 - July 1997
Linda Colville	Project Manager, Boise, Idaho, June 1996 - June 1997
Pat Geehan	Deputy Project Manager/Bureau of Land Management Coordinator, Walla Walla, Washington, February 1994 - December 1997
James E. May	Acting Project Manager, Boise, Idaho, January 1997 - May 1997
Steve Mealey	Project Manager, Boise, Idaho, August 1994 - January 1997
Jodi Clifford	Science Advisory Group Writer/Editor, Bureau of Land Management, Walla Walla, Washington
Richard Phillips	Economist, Forest Service, Regional Office, Portland, Oregon
Gerald Williams	Sociologist, Forest Service, Regional Office, Portland, Oregon (until January 1998)

Many former EIS Team members and representatives from other federal agencies were involved in the development and publication of the Eastside and UCRB Draft EISs. Their work laid the foundation for the continuing efforts on the Supplemental Draft EIS. The contributions of the following individuals, and their agency affiliation at the time of their participation on the EIS Team, are gratefully acknowledged:

Stewart Allen	Forest Service
Steve Bauer	U.S. Environmental Protection Agency
Keith Bennett	BLM
Paul Boehne	National Marine Fisheries Service
Jim Burchfield	Forest Service
Kathy Cushman	BLM

Cindy Deacon-Williams	Forest Service
Marty Dumpis	Forest Service
Leslie Frewing-Runyon	BLM
Deb Hennessey	Forest Service
Howard Hudak	Forest Service
Les Holsapple	Forest Service
Lyle Jensen	Forest Service
Lynn Kaney	Forest Service
Mary Keith	Forest Service
Don Lyon	Forest Service
Ken McDonald	Forest Service
Ed McHugh	U.S. Bureau of Mines
Greg Macheak	Forest Service
Melanie Miller	BLM
Wally Murphy	Forest Service
Jim O'Connor	U.S. Geological Survey
Ralph Perkins	Forest Service
Bill Peterson	Forest Service
Greg Peterson	BLM
George Pozzuto	Forest Service
Dan Robinson	U.S. Environmental Protection Agency
Heidi Sandeno	Forest Service
Leslie Sekavec	Forest Service
Ayn Schlisky	Forest Service
Jim Sparza	Forest Service
Kaz Thea	U.S. Fish and Wildlife Service
Richard Thompson	U.S. Bureau of Mines
Randy Tweten	National Marine Fisheries Service
Pat Zenone	U.S. Fish and Wildlife Service
Elaine Zieroth	Forest Service

Executive Steering Committee

The Executive Steering Committee oversees the project; monitors progress; proposes needed changes, assignments, and amendments; ensures all appropriate participants are involved; proposes resolution to issues; makes decisions; and resolves issues. The BLM State Directors and Forest Service Regional Foresters are the decision makers for the project, working closely with the federal regulatory agency executives.

Jack Blackwell	Forest Service, Regional Office, Ogden, Utah
Dale Bosworth	Forest Service, Regional Office, Missoula, Montana
Denver Burns	Forest Service, Rocky Mountain Research Station, Fort Collins, Colorado
Chuck Clarke	Environmental Protection Agency, Seattle, Washington
Tom Dwyer	U.S. Fish and Wildlife Service, Portland, Oregon
Ken Feigner	Environmental Protection Agency, Seattle, Washington (alternate)
Chuck Findley	Environmental Protection Agency, Seattle, Washington (alternate)
Elizbeth Gaar	National Marine Fisheries Service, Portland, Oregon (alternate)
Paul Gertler	U.S. Fish and Wildlife, Lakewood, Colorado (alternate)
Nancy Graybeal	Forest Service, Regional Office, Portland, Oregon (acting)
Martha Hahn	Bureau of Land Management, Idaho State Office, Boise, Idaho
Larry Hamilton	Bureau of Land Management, Montana State Office, Billings, Montana
Kemper McMaster	U.S. Fish and Wildlife Service, Helena, Montana (alternate)
Ted Meyers	National Marine Fisheries Service, Seattle, Washington (alternate)
Tom Mills	Forest Service, Pacific Northwest Research Station, Portland, Oregon
Ralph Morgenweck	U.S. Fish and Wildlife Service, Denver, Colorado
Jim Owings	Bureau of Land Management, Montana State Office, Boise, Idaho (alternate)
Thomas Quigley	Forest Service, Pacific Northwest Research Station, La Grande, Oregon (alternate)

Bill Shake	U.S. Fish and Wildlife, Portland, Oregon (alternate)
William Stelle	National Marine Fisheries Service, Seattle, Washington
Bob Williams	Forest Service, Regional Office, Portland, Oregon (until June 1999)
Elaine Zielinski	Bureau of Land Management, Oregon/Washington State Office, Portland, Oregon

Key Staff

Forest Service, BLM, and Regulatory Agencies key staff provided a direct link between their member of the ExecutiveSteering Committee and Project staff.

Rick Applegate	National Marine Fisheries Service, Portland, Oregon
Jay Carlson	Bureau of Land Management, Idaho State Office, Boise, Idaho
Joyce Casey	Forest Service, Regional Office, Portland, Oregon (until June 1999)
Laura Ceperley	Bureau of Land Management, Oregon/Washington State Office, Portland, Oregon
Lisa Croft	Forest Service, Regional Office, Portland, Oregon
Bob Davis	Forest Service, Regional Office, Ogden, Utah
Chuck Dunn	U.S. Fish and Wildlife, Portland, Oregon
Ken Feigner	Environmental Protection Agency, Seattle, Washington
Lisa Freedman	Forest Service, Regional Office, Portland, Oregon (until October 1997)
Elizabeth Gaar	National Marine Fisheries Service, Portland, Oregon
Jon Haber	Forest Service, Regional Office, Missoula, Montana (until October 1999)
Dave Harmon	Bureau of Land Management, Oregon/Washington State Office, Portland, Oregon
Jim Kenna	Bureau of Land Management, Oregon/Washington State Office, Portland, Oregon (until March 1998)
Gretchen Lloyd	Bureau of Land Management, Oregon/Washington State Office, Portland, Oregon (until October 1997)
Jim May	Bureau of Land Management, Idaho State Office, Boise, Idaho (until June 1997)
Kathi Moynan	National Marine Fisheries Service, Boise, Idaho
Rick Roberts	Forest Service, Regional Office, Missoula, Montana
Jim Schuler	Forest Service, Regional Office, Portland, Oregon (until July 1999)
Randy Tweten	National Marine Fisheries Service, Portland, Oregon (until March 1999)

Implementation Team

This team was active from June 1996 through publication of the Supplemental Draft Environmental Impact Statement. Their role was to develop strategies for implementation, such as "step-down" procedures, technology transfer to field units, integration of new decisions into existing plans, monitoring plan development, and organizational structure. They also provided input to the EIS Team on the feasibility of implementing the alternatives.

Rick Tholen	Team Leader, ICBEMP, Boise, Idaho (until May 1999)
Carl Pence	Team Leader , ICBEMP, Boise, Idaho (from July 1999)
Lew Brown	Bureau of Land Management, Coeur d'Alene, Idaho
Joyce Casey	Forest Service, Regional Office, Portland, Oregon (until June 1999)
Jim Caswell	Forest Service, Clearwater National Forest, Orofino, Idaho
Bob Davis	Forest Service, Regional Office, Ogden, Utah
Chuck Dunn	U.S. Fish and Wildlife, Portland, Oregon
Rebecca Gravenmier	Bureau of Land Management, ICBEMP, Portland, Oregon
Jon Haber	Forest Service, Regional Office, Missoula, Montana
Jim Hancock	Bureau of Land Management, Prineville, Oregon
Ralph Heft	Bureau of Land Management, Oregon/Washington State Office, Boise, Idaho (until August 1999)
Joe Kraayenbrink	Bureau of Land Management, Idaho Falls, Idaho
Debbie Martin	National Marine Fisheries Service, Boise, Idaho
Kathi Moynan	National Marine Fisheries Service, Boise, Idaho

Rick Roberts	Forest Service, Washington Office, Washington, DC
Jerry Magee	Bureau of Land Management, Oregon/Washington State Office, Portland, Oregon
Bob Ruesink	U.S. Fish and Wildlife Service, Boise, Idaho
Ed Schultz	Forest Service, Colville, Washington (until January 1997)
Randy Tweten	National Marine Fisheries Service, Portland, Oregon (until March 1999)
Cliff Walker	Forest Service, ICBEMP, Walla Walla, Washington
Gary Wyke	Bureau of Land Management, ICBEMP, Boise, Idaho
Cheryle Zwang	Bureau of Land Management, ICBEMP, Boise, Idaho

RISTs (Regional Implementation Support Teams)

Two interagency, interdisciplinary teams (Eastside RIST, for eastern Oregon and eastern Washington, and the Upper Basin RIST, for Idaho and western Montana) were chartered in May 1998 by the Interior Columbia Basin Ecosystem Management Project (ICBEMP) Executive Steering Committee. Team members include specialists from regional, state, supervisor, district and field level offices. The RISTs assist multi-agency personnel from the five cooperating agencies to understand and use the Scientific Assessment and associated data to support and manage Bureau of Land Management- and Forest Service- administered lands within the project area, in an integrated and consistent fashion.

Al Horton	Co-Team Leader, Portland, Oregon
Jim Owings	Co-Team Leader, ICBEMP, Boise, Idaho
Hugh Barrett	Bureau of Land Management, Oregon/Washington State Office, Portland, Oregon
Paul Beckley	Forest Service, Kalispell, Montana
Mark Beighley	Forest Service, Regional Office, Portland, Oregon
Lynn Bennett	Forest Service, Salmon, Idaho
Bill Brookes	Bureau of Land Management, Oregon/Washington State Office, Portland, Oregon
Erick Campbell	Bureau of Land Management, Oregon/Washington State Office, Portland, Oregon
Bill Connelly	Forest Service, Regional Office, Portland, Oregon
Clif Fanning	Bureau of Land Management, Oregon/Washington State Office, Portland, Oregon
Rebecca Gravenmier	Bureau of Land Management, Oregon/Washington State Office, Portland, Oregon
Andy Godfrey	Forest Service, Regional Office, Ogden, Utah
Richard Hanes	Bureau of Land Management, Eugene, Oregon
Richy Harrod	Forest Service, Leavenworth, Washington
Jeff Jones	Forest Service, Kalispell, Montana
Larry Kaiser	Forest Service, Coeur d'Alene, Idaho
Lyle Lewis	Bureau of Land Management, Idaho State Office, Boise, Idaho
Jerry Magee	Bureau of Land Management, Oregon/Washington State Office, Portland, Oregon
Les McConnell	Forest Service, Regional Office, Portland, Oregon
Jim Merzenich	Forest Service, Regional Office, Portland, Oregon
Mike Pellant	Bureau of Land Management, Idaho State Office, Boise, Idaho
Dick Phillips	Forest Service, Regional Office, Portland, Oregon
Fay Shon	Forest Service Regional Office, Portland, Oregon
Jim Thinnes	Forest Service, Walla Walla, Washington
Fred Way	Forest Service, Ashland, Oregon
Ron Wiley	Bureau of Land Management, Prineville, Oregon
Cheryle Zwang	Bureau of Land Management, ICBEMP, Boise, Idaho

Tribal Working Group

The following people worked toward resolution of basin-wide issues identified by the tribes.

Robert Anderson	United States Department of Interior Secretary's Office, Attorney, Seattle, Washington
Jack Blackwell	Forest Service, Regional Forester, Ogden, Utah
Lionel Boyer	Shoshone-Bannock Tribes, Ft. Hall, Idaho
Meridith Bruch	Yakama Nation, Toppenish, Washington

Lee Carlson	Yakama Nation, Toppenish, Washington
Carol Craig	Yakama Nation, Toppenish, Washington
Mike Farrow	CTUIR (Confederated Tribes of the Umatilla Indian Reservation), Pendleton, Oregon
Don Gentry	Klamath Tribes, Chiloquin, Oregon
Martha Hahn	Bureau of Land Management, Idaho State Director, Boise, Idaho
Wendell Hannigan	Yakama Nation, Toppenish, Washington
Charles Lennahan	Office of General Council, Denver, Colorado
Jerry Menninick	Yakama Nation, Toppenish, Washington
Geoff Middaugh	Bureau of Land Management, Deputy Project Manager, Walla Walla, Washington
Elwood Miller	Klamath Tribes, Chiloquin, Oregon
Joe Peone	Colville Tribes, Nespelam, Washington
Jaime Pinkham	Nez Perce Tribe, Lapwai, Idaho
Bill Shake	U.S. Fish and Wildlife Service, Portland, Oregon
Cliff Walker	Forest Service, Tribal Liaison, ICBEMP, Walla Walla, Washington
Jim Weber	Columbia River Inter-Tribal Fish Commission, Portland, Oregon
Robert Williams	Forest Service, Regional Forester, Portland, Oregon (until June 1999)
Cheryle Zwang	Bureau of Land Management, Tribal Liaison, ICBEMP, Boise, Idaho

Legal Team

The Legal Team met periodically with Project staff to provide guidance and feedback as products were developed.

Ted Boling	Department of Justice, Washington, DC
Christine R. Everett	Office of General Counsel, Missoula, Montana
Bradley Grenham	Office of Regional Solicitor, Portland, Oregon
Charles Lennahan	Office of General Counsel, Denver, Colorado (until October 1997)
Karen Mouritsen	Office of the Solicitor, Washington, DC
Ronald Mulach	Office of General Counsel, Washington, DC
Roger Nesbit	Office of Regional Solicitor, Portland, Oregon
Melanie Rowland	Department of Commerce, Seattle, Washington
Owen Schmidt	Office of General Counsel, Portland, Oregon
Joe Stringer	Office of General Counsel, Ogden, Utah

Budget Implementation Strategy Team

Andy Brunelle	Forest Service, ICBEMP, Boise, Idaho
Donna Buchanan	Bureau of Land Management, Oregon/Washington State Office, Portland, Oregon
Randy Cross	National Marine Fisheries Service, Seattle, Washington
Charles A. Dunn	U.S. Fish and Wildlife Service, Portland, Oregon
Rich Duperon	Forest Service, Regional Office, Portland, Oregon
Ken Feigner	Environmental Protection Agency, Seattle, Washington
Jon Foster	Bureau of Land Management, Boise, Idaho
Becky Gravenmier	Bureau of Land Management, ICBEMP, Portland, Oregon
Galen Hall	Forest Service, Regional Office, Missoula, Montana
Ken Kiser	Forest Service, Regional Office, Ogden, Utah
Darwin Priebe	Bureau of Land Management, Oregon/Washington State Office, Portland, Oregon
Deanna Mendiola	Forest Service, ICBEMP, Boise, Idaho
Ted Meyers	National Marine Fisheries Service, Seattle, Washington
Geoff Middaugh	Bureau of Land Management, ICBEMP, Walla Walla, Washington
Hugh Morrison	U.S. Fish and Wildlife Service, Portland, Oregon
Dick Ottesen	Forest Service, Regional Office, Ogden, Utah
Gaston Porterie	Forest Service, Regional Office, Portland, Oregon
Cheryl Reynolds	Bureau of Land Management, Idaho State Office, Boise, Idaho
LaVerne Scott	Forest Service, ICBEMP, Walla Walla, Washington

Agencies and Organizations Contacted

The Project staff either contacted or received input from many of the following agencies, representatives, and organizations during the development of the EIS and associated documents. Other agencies and organizations listed were sent copies of the Supplemental Draft EIS or Executive Summary of the Supplemental Draft EIS. Individuals are not included in this list, nor are individual agency officers.

Federal Agencies

Environmental Protection Agency

Department of Energy
Bonneville Power Administration

Department of the Interior
Bureau of Indian Affairs
Bureau of Land Management
Bureau of Mines
Bureau of Reclamation
Field Solicitor's Office
National Biological Service
National Park Service
U.S. Fish and Wildlife Service
U.S. Geological Survey

Department of Agriculture
Natural Resources Conservation Service
Forest Service
Animal and Plant Health Inspection Service
Office of General Council
Agriculture Research Station
Forestry Sciences Lab

Department of Defense
U.S. Army Corps of Engineers
Department of the Air Force
Department of the Army
Naval Air Station Whidbey Island

Department of Commerce
National Marine Fisheries Service

Department of Justice

Library of Congress

Federal Regulatory Commission

General Accounting Office

State Representatives and Senators

Senator Laird Noh, Idaho
Senator Judi Danielson, Idaho
Senator Ric Branch, Idaho
Senator Dean Rhoads, Nevada
Senator Brady Adams, Oregon
Senator Neil Bryant, Oregon
Senator Eugene Timms, Oregon
Senator Ted Ferrioli, Oregon
Senator Richard Russman, New Hampshire
Representative Charles Cuddy, Idaho
Representative Jeff Alltus, Idaho
Representative Michael Simpson, Idaho (former)
Representative Liz Van Leeuwen, Oregon
Representative Dennis Luke, Oregon (former)
Representative Del Parks, Oregon (former)
Representative Bill Markham, Oregon (former)
Representative Bob Lawson, Montana
Representative Scott Orr, Montana
Representative Aubyn Curtiss, Montana
Representative Mark Schoesler, Washington
Representative George Orr, Washington
State of Wyoming
State of Utah
John Carpenter, Nevada Assembly

Governors

Governor Cecil D. Andrus, Idaho (former)
Governor Phillip Batt, Idaho (former)
Governor Dirk Kempthorne, Idaho
Governor Marc Racicot, Montana
Governor Barbara Roberts, Oregon (former)

Governor John A. Kitzhaber, Oregon
Governor Mike Lowry, Washington (former)
Governor Gary Locke, Washington

U.S. Senate

Senator Mike Crapo, Idaho
Senator Dirk Kempthorne, Idaho (former)
Senator Larry Craig, Idaho
Senator Conrad Burns, Montana
Senator Max Bauchus, Montana
Senator Harry Reid, Nevada
Senator Richard Bryan, Nevada
Senator Ron Wyden, Oregon
Senator Gordon Smith, Oregon
Senator Mark Hatfield, Oregon (former)
Senator Robert Packwood, Oregon (former)
Senator Orrin Hatch, Utah
Senator Robert Bennett, Utah
Senator Slade Gorton, Washington
Senator Patty Murray, Washington

U.S. Representatives

Representative Larry LaRocco, Idaho (former)
Representative Helen Chenoweth, Idaho
Representative Michael Simpson, Idaho
Representative Robert F. Smith, Oregon (former)
Representative Greg Walden, Oregon
Representative Elizabeth Furse, Oregon (former)
Representative Wes Cooley, Oregon (former)
Representative Rick Hill, Montana
Representative Jim Gibbons, Nevada
Representative James Hansen, Utah
Representative Thomas Foley, Washington (former)
Representative Doc Hastings, Washington
Representative George Nethercutt, Washington
Representative Cathy McMorris, Washington
Representative Jack Metcalf, Washington
Representative Norm Dicks, Washington
Representative Jim McDermott, Washington
Representative Barbara Cubin, Wyoming

American Indian Tribal Governments and Other Organizations

Affiliated Tribes of Northwest Indians
Blackfeet Tribes
Burns-Paiute Tribe
Bureau of Indian Affairs
Canadian Columbia River Inter-Tribal Fish Commission
Coeur d'Alene Tribe
Columbia River Inter-Tribal Fish Commission
Colville Confederated Tribes
Confederated Salish and Kootenai Tribes (Flathead Reservation)
Confederated Tribes of the Umatilla Reservation
Confederated Tribes of the Warm Springs Indian Reservation
Cowlitz Tribe
Crow Tribal Cultural Committee
Fort Bidwell Paiute
Fort McDermitt Paiute
Intertribal Timber Council
Kalispell Tribe
Klamath Indian Game Commission
Klamath Tribes
Kootenai Tribe
Legal Commission on Indian Service
Native American Fish and Wildlife Society
Nez Perce Tribe
Northwest Band of Shoshoni Nation
Northwest Indian Fish Commission
Pit River Tribes
Puyallup Tribe
Quartz Valley Indian Community of the Quartz Valley Reservation of California
San Carlos Apache Tribe
Shoshone Tribe of the Wind River Reservation
Shoshone-Bannock Tribes (Fort Hall Reservation)
Shoshone-Paiute Tribes (Duck Valley Reservation)
Spokane Tribe
Summit Lake Paiute (Summit Lake Reservation)
Wanapum Tribal Community
Yakama Nation

State Agencies

Oregon

Bureau of Labor and Industries
Dispute Resolution Committee
Office of the Governor
Oregon Employment Department
Oregon Department of Agriculture
Oregon Department of Environmental Quality
Oregon Department of Fish and Wildlife
Oregon Department of Forestry
Oregon Department of Transportation
Oregon Economic Development Department
Oregon Governor's Federal Forest and Resource Policy Team
Oregon Legislative Commission on Indian Service
Oregon Water Resources Department
Oregon Parks and Recreation
Oregon Department of Energy
Oregon State Government

Washington
Washington Conservation Commission
Washington Department of Ecology
Washington Department of Natural Resources
Washington Department Wildlife
Washington Department of Transportation
Washington Noxious Weed Control Board
Washington Governors Office of Indian Affairs
Washington Department of Agriculture
Washington State Library
Washington Department of Parks and Recreation
Washington Department of Fish and Wildlife
Washington Department of Environmental Quality

Idaho
Idaho Department of Environmental Quality
Idaho Department of Fish and Game
Idaho Department of Lands
Idaho Department of Transportation
Idaho Department of Water Resources
Idaho Department of Parks and Recreation
Idaho Department of Health and Welfare
Idaho Forest Congress Steering Committee
Idaho Geological Survey
Idaho State Department of Agriculture
Idaho Department of Commerce
Idaho Department of Employment
Idaho Rural Partnership
Idaho Public Utilities

California
California Department of Forestry and Fire

Colorado
Division of Wildfire

Montana
Montana Department of Fish, Wildlife, and Parks
Montana State Department of Ecology
Montana Department of Fish and Game
Montana Department of Lands
Montana Fish and Wildlife Program
Montana Department of Environmental Quality

Nevada
Agency for Nuclear Projects
Legislative Committee on Public Lands
Legislative Counsel Bureau
Natural Heritage Program
Nevada Department of Conservation and Natural Resources
State Assembly
Nevada State Clearinghouse

North Dakota
Department of Fish and Game

Alaska
Department of State and Private Forestry

Wyoming
Wyoming State Library
Wyoming State Engineering Office
Wyoming State Clearinghouse

Utah
Utah Department of Environmental Quality

Local Governments, Association of Governments and Other Government Bodies

Ada County, Idaho
Adams County, Idaho
Adams County, Washington
Asotin County, Washington
Baker County, Oregon
Baker Economic Development, Oregon
Bannock County, Idaho
Bear Lake County, Idaho
Beaverhead County, Montana
Benewah County, Idaho
Benton City Noxious Weed Control Board, Washington
Benton County, Oregon
Benton County, Washington
Benton County Planning Department, Washington
Benton/Franklin Council of Governments, Washington
Bingham County, Idaho
Blaine County, Idaho
Blaine County, Montana
Blaine County Recreation District
Boise County, Idaho
Bonner County, Idaho
Bonneville County, Idaho
Boundary County, Idaho
Box Elder County, Utah
Butte County, Idaho
Butte-Silver Bow Planning Department

Camas County, Idaho
Canyon County, Idaho
Caribou County, Idaho
Cassia County, Idaho
Cassia County Assessor, Idaho
Chelan County, Washington
Chelan County Conservation District, Washington
Chouteau County, Montana
City of Baker City, Oregon
City of Bend, Oregon
City of Deerlodge, Montana
City of Eureka, Montana
City of Grace, Idaho
City of Kamiah, Idaho
City of Ketchum, Idaho
City of Klamath Falls, Oregon
City of LaGrande, Oregon
City of Libby, Montana
City of Moscow, Idaho
City of Moses Lake, Washington
City of Rexford, Montana
City of Richland, Washington
City of Salmon, Idaho
City of Stites, Idaho
City of The Dalles, Oregon
City of Twisp, Washington
Clark County, Idaho
Clark County, Washington
Clearwater County, Idaho
Coeur d'Alene City, Idaho
Columbia Conservation District, Washington
Columbia County, Oregon
Columbia County, Washington
Crook County, Oregon
Custer County, Idaho
Custer County, Montana
Daggett County, Utah
Deschutes County, Oregon
Douglas County, Oregon
Douglas County, Washington
Douglas County Transportation, Washington
Douglas Public Utility District, Washington
Elko County, Nevada
Elmore County, Idaho
Elmore County Extension Office, Idaho
Eureka County, Montana
Eureka County Department of Public Works, Montana
Ferry County, Washington
Ferry County Conservation District, Washington
Ferry County Planning Department, Washington
Flathead County, Montana
Flathead County Conservation District, Montana
Franklin County, Idaho
Franklin County, Washington
Fremont County, Idaho
Fremont County, Oregon
Gallatin County, Montana
Garfield County, Montana
Garfield County, Washington
Gem County, Idaho
Gilliam County, Oregon
Gooding County, Idaho
Grangeville Library, Idaho
Granite County, Montana
Grant County Assessor, Oregon
Grant County Court, Oregon
Grant County Conservationists, Oregon
Grant County, Oregon
Grant County Public Utility District, Washington
Grant County, Washington
Grant Soil and Water Conservation District, Washington
Hamilton City Library, Montana
Harney County, Oregon
Harney County Soil Conservation Service District, Oregon
Harney Soil and Water District, Oregon
Hidalgo County, New Mexico
Hidalgo Soil and Water Conservation District, New Mexico
Hood River City Commission, Oregon
Hood River County, Oregon
Humboldt County, Nevada
Idaho County, Idaho
Jefferson County, Idaho
Jefferson County, Oregon
Jefferson County, Montana
Jefferson County, Washington
Jefferson County Weed Board, Montana
Jerome County, Idaho
Kettle Falls City Council, Washington
Kings River Conservation District, California
Kittitas County, Washington
Klamath County, Oregon
Klickitat County, Washington
Klickitat County Courthouse, Washington
Kootenai County, Idaho
Kootenai County Natural Resources, Idaho
Lake County, Montana
Lake County, Oregon
Lakeview Water Conservation District, Washington
Lane County, Oregon
Latah County, Idaho
Lemhi County. Idaho
Lewis and Clark County, Montana
Lewis County, Idaho
Lewis County, Washington
Lewis County Weed Control, Idaho
Lexington Fayette Urban County, Kentucky
Lincoln Community Council, Montana
Lincoln County Conservation District, Washington
Lincoln County, Idaho
Lincoln County, Oregon
Lincoln County, Montana
Lincoln County, Washington

Madison County, Idaho
Madison County, Montana
Magic Valley Resource Council, Idaho
Malheur County, Oregon
Meadow Brook Conservation Association, California
Mineral County, Montana
Minidoka County, Idaho
Missoula Conservation District, Montana
Missoula County, Montana
Morrow County, Oregon
Morrow Soil and Water Conservation District, Oregon
Nez Perce County, Idaho
Ochoco Irrigation District, Oregon
Okanogan Conservation District, Washington
Okanogan County, Washington
Okanogan Irrigation District, Washington
Oneida County, Idaho
Oroville-Tonasket Irrigation District, Washington
Owyhee County, Idaho
Palouse Conservation District, Washington
Panhandle Health District 1, Idaho
Park County, Montana
Payette County, Idaho
Pend Oreille County, Washington
Pend Oreille County Library District, Washington
Powell County, Montana
Power County, Idaho
Prairie County, Montana
Prairie County Grazing District, Montana
Ravalli County, Montana
Sanders County, Montana
Sherman County Court, Oregon
Shoshone County, Idaho
Skagit County, Washington
Skamania County Department of Planning, Washington
South Douglas Conservation District, Oregon
Spokane Conservation District, Washington
Spokane County, Washington
Spokane Public Library, Washington
Stanley Post Office, Idaho
Star Valley Conservation District, Wyoming
Stevens County, Washington
Stevens County Conservation District, Washington
Stevensville Library, Montana
Teton County, Idaho
Teton County, Montana
Town of Eureka, Montana
Town of Odessa, Washington
Twin Falls County, Idaho
Twin Falls County Extension Office, Idaho
Umatilla County, Oregon
Union County, Oregon
Union County Scoping Team, Oregon
Union County Weed Control, Oregon
Valley County, Idaho
Valley County, Montana
Walla Walla County, Washington
Walla Walla County Conservation District, Washington
Walla Walla River Irrigation District, Washington
Wallowa County, Oregon
Wasco County, Oregon
Wasco County Irrigation District, Oregon
Wasco County Soil and Water District, Oregon
Washington County, Idaho
Washington County, Oregon
Washington County, Utah
Washington County Oversight Committee, Utah
Whatcom County, Washington
Wheeler County , Oregon
Whitman County, Washington
Yakima County, Washington
Yellowstone County, Montana

Canadian Agencies

British Columbia Ministry of Agriculture, Fisheries, and Food
British Columbia Ministry of Business, Tourism and Culture
British Columbia Ministry of Environment, Lands and Parks
British Columbia Ministry of Forests
Canadian Wildlife Service
Department of Canadian Heritage
Ministry of Agriculture
Northern Affairs Program

Resource Advisory Councils

Butte Resource Advisory Council
Eastern Washington Resource Advisory Council
John Day/Snake River Resource Advisory Council
Lewistown Resource Advisory Council
Lower Snake River Resource Advisory Council
Northeast Great Basin Resource Advisory Council
Southeastern Oregon Resource Advisory Council
Upper Columbia Salmon/Clearwater Resource Advisory Council Region 1
Upper Columbia Salmon/Clearwater Resource Advisory Council Region 4
Upper Snake Resource Advisory Council

Provincial Advisory Committees

Deschutes Provincial Advisory Committee
Eastern Washington Cascades Provincial Advisory Committee
Klamath Provincial Advisory Committee
Yakima Provincial Advisory Committee

Schools and Universities

Altamont High School, Utah
Boise State University, Idaho
California State Polytechnic University
Calvin College, Missouri
Catholic University of America, Washington, D.C.
Central Oregon Community College
Central Washington University
Clemson University, South Carolina
Colorado State University
Columbia Basin Institute, Washington
Columbia University, New York
Colville School District, Washington
Cornell University, New York
Dayton Junior High School, Washington
Eastern Oregon University
Eastern Washington University
Environmental Law Institute, Washington, D.C.
Fort Lewis College, Colorado
George Mason University, Virginia
Gonzaga University, Washington
Grays Harbor College, Washington
Humboldt State University, California
Idaho State University
Lewis and Clark College, Oregon
Lewis and Clark Law School, Oregon
Liberty School District, Washington
Middlebury College, Vermont
Montana State University
Moscow High School, Idaho
North Carolina State University
North Salem High School, Oregon
Northern Arizona University
Northwestern University, Illinois
Ohio State University
Omak High School, Washington
Oregon Institute of Technology
Oregon State University
Pacific Crest Outward Bound School, Oregon
Penn State Dubois Campus, Pennsylvania
Pomona College, California
Portland State University, Oregon
Rice University, Texas
Salish Kootenai College, Montana
Santa Fe Community College, New Mexico
Simon Frazier University, B.C., Canada
Skagit Valley College, Washington
State University of New York
Sunshine Preschool
University of Arizona
University of British Columbia
University of California
University of California at Davis
University of Colorado Law School
University of Idaho
University of Illinois
University of Maryland
University of Michigan
University of Minnesota
University of Montana
University of Nevada
University of North Dakota
University of Oklahoma
University of Oregon
University of Pittsburgh, Pennsylvania
University of Scranton, Pennsylvania
University of Tennessee
University of Texas at Austin
University of Utah
University of Vermont
University of Washington
Utah State University
Virginia Polytechnic Institute and State University
Walla Walla College, Washington
Walla Walla Community College, Washington
Washington State University
Willamette University, Oregon
Whitman College, Washington
Whitworth College, Washington
Yale University, Connecticut

Interested Groups, Businesses, and Organizations

1000 Friends of Oregon
3-D Ranches
4-0 Cattle Company
8th District Conservation Coalition

A

Aaron Carvey Logging Company
AB Logging, Inc.
Aberdeen Daily World
Acupuncture Center of Cary
Aerial Forest Management Foundation
Aesthetic Plastic Surgery Center
Agency for Nuclear Projects
Agri Beef Company
Agri-Times Northwest
Agriculture Futures
AH Kimpton and Sons, Inc.
Ahlstrom Construction Company, Inc.
Akee, Inc.
Alabama Woodlands, Inc.
Alaska Miners Association
Albeni Falls Project
Alliance for the Wild Rockies
Alpha Omega Marketing
Alpine Lakes Protection Society
Alpine Log Homes
ALX Ranch
American Bar Association
American Farm Bureau Federation
American Fisheries Society
American Forest and Paper Association
American Forests
American Lands Access Association, Incorporated
American Lands Alliance
American Public Land Exchange Company
American Recreation Coalition
American Resource Analysis, Inc.
American Rivers
American Sheep Industry
American Society of Civil Engineers
American Wildlands
AMREPRO, Incorporated
Anderson Forestry Consulting
Anderson, Perry and Associates
Andrew Kortes and Son's, Inc.
Andrus Center for Public Policy
Animal Damage Control
Anti-Vivisection Society of America, Inc.
Antioch Living Systems Collective
Antoine and Son
Applehandz Brothers
Applied Biomathematics
Aquatic Ecosystem Association
Architect Chartered
Arden Tree Farms
Argus Observer
Arrow Forest District
ASARCO, Inc.
Ashland Daily Tidings
Aspen Environmental Group
Aspir, Inc.
Associated Logging Contractors, Inc.
Associated Oregon Industries
Associated Oregon Loggers, Inc.
Associated Press
Association of Oregon Counties
Association of the Northwest Steelheaders
Atascosa Ranch
Atterbury Consultants, Inc.
Audubon Society
Aura of the Arts, Inc.
Axis Environmental Consultants
Ayres, Baker Pole

B

B.A. Mullican Lumber and Manufacturing Company
B.L. Cooper, Inc.
B and N Trucking
Backcountry Horsemen
Backcountry Horsemen of Washington
Baker City Herald
Baker County Chamber of Commerce, Oregon
Baker County Livestock Association
Baker Economic Development
Balanced Resource Solutions
Balfour Lumber Company, Inc.
Ball Brothers
Ballard Logging
Bank of Eastern Oregon
Bar 22 Ranch
Barbee Mill Co., Inc.
Bar-M Ranch
Bardwell Logging, Inc.
Barnes Ranches, Inc.
Barry Benson Logging
Basic American Foods
Basin Vision Group
Battelle Pacific Northwest Laboratories
Battelle Seattle Research Station
Battle Mountain Gold Company
Beak Consultants
Bear Creek Log Homes
Bear Creek Logging
Bear Creek Tree Farms
Bear Engineering
Beaulieu Trucking
Bell-A Land and Cattle

Bellingham Herald
Bender Tree Farms
Bennett Lumber Products, Inc.
Benson Farms
Bentley Ranches
Bermuda Research Corporation
Bessemer Plywood Corporation
Bethell Logging Corporation
Big Bend Economic Development Council
Big Joys, Inc.
Big Wild Advocates
Bill Moran Woodcrafting
Bill Pluid Logging
Bill's Body Paint
Bioanalysts
Biodiversity Legal Foundation
Bioeconomics, Inc.
Biological Consultants
Bioregional Assessments
Bitterroot Backcounty Horsemen
Bitterroot-Mission Group
Bitterroot Valley Chamber of Commerce, Montana
Bitter Root Water Forum
Blanthorn Ranch
Blatter Ranch, Inc.
Blue Heron Publishing, Inc.
Blue Mountain Chapter Trout Unlimited
Blue Mountain Eagle
Blue Mountain Environmental Council
Blue Mountain Forest Products, Incorporated
Blue Mountain Lumber Products
Blue Mountain Native Forest Alliance
Blue Mountain Natural Resources Institute
Blue Mountain Protection Alliance
Blue Mountain Resource Conservation and Development
Blue Mountains Biodiversity Project
Blue Ribbon Coalition
Blue Ridge Associates, Inc.
Bogus Basin
Boies Ranch
Boise Cascade Corporation
Boise Rotary
Bonner County Daily Bee
Boone and Crockett Club
Bootheel Heritage Association
Boulder-White Clouds Council
Brackett Livestock, Incorporated
Brand S Lumber
Branner Lumber
BRBO Organization
Bridger Mountain Log Homes, Inc.
Bristol Timber Company, Inc.
British Columbia Lands
Broughton Land Company
Brown and Coldwell
Brown Logging
Brown's Industries
Bruce Kainz Logging
Brundage Mountain Company
Brush Brunch Motorcycle Club
BTO Logging, Inc.
Buck Adams Trucking, Inc.
Buck Creek Ranch
Budd-Falen Law Offices, P.C.
Buehler Lumber Company
Buhl Cattle Ranch
Bullitt Foundation
Burke Museum
Burlington Resources Oil and Gas Company
Burney Forest Products
Burns Times Herald
Burris Pulpwood Company
B.V.F.S.
By Way Ministry
Byington Ranch

C

C Bar M Daily
CAGE
Caldwell R and E Center
California Forestry Association
California Mule Deer Association
Camp Fire Boys and Girls
Camp Kiwanilong
Canal Industries, Inc.
Canal Wood Corporation of Lumberton
Canyon Creek Project
Community Action Program East Central Oregon
Capitol Press
Caribou Cattlemen's Association
Carl A. Johnson Logging Company
Carter Agri-Systems
Carvey Logging
Cascade Cattleman Magazine
Cascade Institute
Cascade Reservoir Association
Cascade Science School - OMSI
Cascade Woodlands
Cascadia Forest Alliance
Cascadian Institute
Cashmere Records
Cassia County Public Lands Committee
CASU
CE Exploration
Cegavske, Johnston, Yockim and Associates
Center for Earth and Environment
Center for Environmental Equity
Centerville Grange #81
Central Cascades Alliance
Central Cascades Biodiversity Project
Central Oregon Forest Issues Committee
Central Oregonian
CFP
Challis Chamber of Commerce, Idaho

CH2M Hill
Challis Messinger
Charlottesville Wellness Center
Chases Logging
Chaste Tree Farms
Chelan County Citizens Coalition
Chelan Valley Mirror
Cheney-Cowles Museum
Chicago Tribune
Chilton Engineering
Christensen and Associates
Chronicle
Church of the Free Spirit
Circle KBL Outfitters
Citizen Communicator
Citizens for a Strong America
Citizens United for a Realistic Environment
Citizen's Action Coalition of Indiana
Citizen's Resource Group
City Club
City of Rocks National Preserve, Idaho
Clark Oil Company, Inc.
Clark Fork Coalition
Clark Logging
Clean Water Work Group
Clear Acres
Clear Creek Grazing Company
Clearwater Biodiversity Project
Clearwater Biostudies, Inc.
Clearwater Economic Development Association
Clearwater Forest Watch Coalition
Cleaveland Street Square
Cliff Lake Lodge
Clifton GeoScience
Clinical Laboratory Medical Group
Clinton Logging
Clouston Energy Research
Cloverdale Ranch
CM3
Coal Creek Grazing
Coalition for Idaho High Desert
Coalition for Liveable Washington
Coalition of Canyon Preservation
Coeur d'Alene Audubon Society
Coeur d'Alene Chamber of Commerce, Idaho
Coeur d'Alene Watershed Environment
Cogan, Owens, Cogan
Cohig and Associates
Colorado Grizzly Project
Columbia Basin Fish and Wildlife Authority
Columbia Basin Nursery
Columbia Basin River Study Group
Columbia Basin Trust
Columbia Bioregion Education Project
Columbia Falls Area Chamber of Commerce, Montana
Columbia Plywood
Columbia River Bioregion Campaign
Columbia River Conservation League
Columbia River Pastoral Letter Project
Columbian, CRBEP
Colville Chamber of Commerce, Washington
Colville Fuel and Lumber
Colville Post and Poles
Cominco American, Inc.
Committee for Idaho High Desert
Committee Monitoring Mined Minerals
Common Sense Resource League
Communities for a Great Northwest
Competitive Enterprise Institute
Concerned Friends of the Winema
Conservation Coalition
Conservation Department of the Appalachian Mountains Club
Conservation Farm Service Agency
Consulting Forestry
Continental Divide Trail Society
Control Tech Electric Company
Coopers and Lybrand
Cortez Gold Mines
Coulston Energy Research
Country Printing
County Cattleman
County Planning Board
Cove/Mallard Coalition
Cowan Cattle Company
Craighead Wildlife-Wildlands Institute
Craner Logging, Inc.
Crater Lake Ecosystem Alliance
Creek Timber
Croman, Inc.
Crook County Chamber of Commerce, Oregon
Crook County Stockgrowers
Crossroads
Croucher Logging
Crown Pacific
Crows Nest Tree Farm
Crozler Canyon Ranch
CTWS Natural Resources
Culture and Heritage Commission
Cummins Northwest, Inc.
Cunningham Sheep Company
Curly's Sales and Service
Curt's Guide Service
Custer County Farm Bureau
Custom Log Homes
C.W.A.

D

D & L Timberlands
Daigle and Associates, Incorporated
Daily Courier
Daily Journal American
Daily Journal of Commerce
Daily Sentinel

Dale Hall and Associates
Dalton Livestock
Dames and Moore
Dan Averett Trucking
Darby Library
Darrell Copper Logging, LLC.
Davereen and Company
David Evans and Associates
David L. Benson Logging
Dawson Logging, Inc.
Dawson Trucking
Dayton Chronicle
DBA Delta
DC Enterprises
Decision Sciences Institute
Deerlodge Snowmobile Club
Defenders of Wildlife
Deherra Brothers
Denharco USA, Inc.
Department of Forestry and Fire Protection
Department of Resources and Economic Development
Deruwe, Inc.
Deschutes Basin Land Trust
Deschutes Basin Research Conservancy
Deschutes Pine
Desert Research Institute
DETD
Devil Creek Ranch
DeWitt Agriculture Associates
Diamond Cattle Company
Diamond Rash Gordon and Jackson
Diesel Shop, Inc.
Differential Engineering, Inc.
Dornan's Moose Enterprise
Double D Logging
Douglas County Cattlemen's Association
Douses
Dowlanco
D.R. Johnson Lumber Companies
Dri Water, Inc.
DSA, Inc.
Dubois Leather
Dunau Associates

E

EA Engineering, Science and Technology
EA West
Eagle Mapping, Inc.
Eagle-Picher Minerals, Inc.
Eagle Rock Backcountry Horsemen
Earth and Environmental, Inc.
Earth First!
Earth Justice Legal Defense Fund
East Lake Audubon Society
East Oregonian
East Oregon Forest Protective Association
East Washingtonian
Eastern Oregon Agricultural Research Center
Eastern Oregon Agriculture
Eastern Oregon Mining Association
Eastern Washington Dirt Riders Association
Eastfork Livestock
Eastside Ecosystem Coalition of Counties
Eastside Forestry Practices
Eastside Task Force
Ebel and Associates
Eco Analysts, Inc.
Eco Bay
Eco Northwest
Eco Tours of Oregon
Eco-Nomic Environmental Services
Eco-Solutions
Eco-Watch
Ecologic Geological Environments
Ecologic, Inc.
Ecological Services
Ecologically Sustainable Development
Ecology and Environmental, Inc.
Ecology Center
Economic Modeling Specialists
Ecosystem Conservation Ontologists
Ecosystem Equity Council
Ecosystem Restoration Office
EDAW
ED Bessey & Son
EEC and Associates
EESI Weekly Bulletin
E.F.L., Inc.
EFTF
EH Tulgestka & Sons, Inc.
Elko Daily Free Press
Elko Rocky Mountain Elk Foundation
Ellensburg Daily Record
Ellingson Lumber Company
Elma Truck and Trailer
Elmwood Ranch, Incorporated
Emett Trucking
Endangered Species Report
ENSR Consulting and Engineering
Environment and Energy Study
Environment Canadian
Environmental and Geological Services
Environmental Descent Fund
Environmental Engineer Blount, Inc.
Environmental Finance Center
Environmental Grassroots Program
Environmental Management Consulting
Environmental News Network
Environmental Planning and Analysis
Environmental Professionals
Environmental Quality Council
Environmental Research Info Center
Environmental Research Laboratory
Environmental Strategies
Environmental Systems Resource Institute

Environomics
Enviroscience, Inc.
EOATVA
EP Frazier, Inc.
Equipment Repair, Inc.
ESCO Corporation
Esquire
Essa Technology
ESSLA
Esvelt Environmental Engineering
Eugene Register Guard
Eureka Chamber of Commerce, Montana
Eureka County Daughters of American Revolution
Eureka Study Group
Evans, Craven, and Lackie, P.S.
Evergreen Foundation
Exchange Club

F

Fackenthall and Bendle
Far West Fertilizer and Agrichemical Association
Farm Bureau Network
Farm Credit Service
Federal Environmental Issues Company
Federal Land Policy Office
Federal Lands Advisory Committee
FENS
Ferry County Action League, Washington
FH Stoltze Land and Lumber Company
Fir Run Nursery
Fire Island National Seashore Advisory Board
First Security Bank of Kalispell
First State Bank of Thompson Falls
Fishing and Hunting News
Five J's Ranch, Inc.
Five Valleys Audubon Society
Flat Top Sheep Company
Flathead Basin Commission
Flathead Biological Station
Flathead Lakers
Flathead Wildlife, Inc.
Flying Resort Ranches
Flying U Ranch
FNAWS
For The Sake of the Salmon
Forest Futures
Forest Guardians
Forest Management and Economics
Forest Renewal
Forest Resource Management, Inc.
Forest Service Employees for Environmental Ethics
Forest Watch Program
Forests Forever
Fort James Corporation
Foster Ranch, Inc.
Foster Wheeler Environmental Corporation
Four Seasons Forestry
Fremont Sawmill/Collins Products
Freres Lumber Company, Inc.
Friends of Breitenbush Cascades
Friends of Hells Canyon National Recreation Area
Friends of Lime Creek
Friends of Neotropic Migrants
Friends of the Bitterroot
Friends of the Clearwater
Friends of the Earth
Friends of the Green Springs
Friends of the Lemhi River
Friends of the Nevada Wilderness
Friends of the Walla Walla River Basin
Friends of the West
Friends of the Wild Swan
Frontier Lumber Corporation
Frontier Repair
FXL Radio Newsroom

G

Gallatin Backcountry Horseman
Gallatin Group
Gallatin Valley Snowmobilers Asscociation
Gallatin Wildlife Association
Garcia and Associates
Gardner Logging
Garton and Associates Realtors
Gates Lumber Company, Inc.
Gaylord Container Corporation
Gazette Times
Gazette Tribune
GEA/Eastside Task Force
Gem Courier Service
GEO-Marine, Inc.
Georgetown Lake Home Owners Association
Georgia-Pacific Corporation
Gerber Ranch
Gia Cometto Ranch
Gibbs Organic Produce and Lite Logging
Gibco Heavy Equipment Parts
Gilbert Law Office
Givens, Pursley and Huntley
Glacier Institute
GMT Consultants
Goathouse Graphics
God Fearing Brothers Logging
Gold Creek Cattle Company
Gold Prospectors Association of America
Gold Ring Mining
Golden Queen Mining Company
Golden Sunlight Mines
Goodman and Bollar Law Office
Goodman Forest Industries
Gough, Shanahan, and Others
Governor's Federal Forest and Resource Policy Team
Governor's Watershed Enhancement Board
GPA Claims

Grande Coulee Star
Grande Ronde Model Watershed Project
Grande Ronde Resource Council
Grangeville Gem Team
Grant County Farm Bureau
Grant County Press
Grant County Stockgrowers
Grant Harsing Trucking, Inc.
Grant-Kohrs Ranch
Grants Pass Daily Courier
Grassroots for Multiple Use
Graystone Development and Construction
Great Falls Tribune
Great Western Lumber Company
Greater Bonners Ferry Chamber of Commerce, Idaho
Greater Ecosystem Alliance
Greater Pasco Chamber of Commerce, Washington
Greater Wyoming Valley Audubon
Greater Yellowstone Coalition
Green Mountain Institute for Environmental Democracy
Green Mountain Student Co-op, Inc.
Greenpeace Canada
Greene Valley Retreat
Grove and Morgan
Growing Communities for Peace
Guerry, Inc.
Gull Printing
Guwwels Logging
Guy Bennett Lumber Company
Guyer, Lindley and Bailey
Gwynn Lumber and Reload, Inc.

H

H and M Enterprises
H and R Engineering
Hagerman National Fish Hatchery
Hall and Associates
Hall Logging Company
Hammond Ranches, Inc.
Hankins Lumber Company, Inc.
Harder Hereford Ranch
Harney County Chamber of Commerce, Oregon
Harney Electric Cooperative
Harza Engineering Company
Haulah Resources
Haynes Logging
HDR Engineering
Headwaters
Heinz Center
Heldret Publications
Helena Chamber of Commerce, Montana
Helena Independent Record
Hells Canyon Journal
Hells Canyon Preservation Council
Henderson Logging
Henry's Fork Foundation, Inc.
Hermiston Herald
Hide Creek Ranch
High Country News
High Desert Backcountry Horsemen
High Desert Coalition, Inc.
High Desert Ecological Research Institution
High Desert Museum
Hill Camp Corporation
Historic Preservation Advisory Council
Holland and Hart
Hollopeter Logging
Hollopeter Trucking
Holt Ranches, Inc.
Holtz, Inc.
Homestake Mining Company
Hoo-Hoo International
Hood River News
Hopper Logging
Hornacker Wildlife
Houtz Farms
Howard Tree Farms Limited
Huffman Logging, Inc.
Hughes Construction, Inc.
Human Nature
Humboldt Sun
Hunsaker, Inc.
Hunter Logging
Hunters for Conservation
Hydrometrics, Inc.

I

Icicle Canyon Coalition
Idaho Association of Counties
Idaho Cattle Association
Idaho Chapter OCTA
Idaho City Free Press
Idaho Conservation Group
Idaho Conservation League
Idaho Consolidated Metals
Idaho Consumer Affairs, Inc.
Idaho Council on Industry and Environment
Idaho Environmental Council
Idaho Falls Post Register
Idaho Farm Bureau Federation
Idaho Farm Bureau News
Idaho Forest Congress
Idaho Forest Industry Association
Idaho Forest Products Commission
Idaho Forest, Wildlife and Range
Idaho High Desert
Idaho Legislative Council
Idaho Mining Association
Idaho Mountain Express
Idaho National Engineering and Environmental Laboratory
Idaho Outfitters and Guides Association
Idaho Panhandle Backcountry Horseman

Idaho Power Company
Idaho Print Media
Idaho Rangeland Resource Council
Idaho Rivers United
Idaho Rivers Working Group
Idaho Rural Development Council
Idaho Spokesman Review
Idaho Statesman
Idaho Steelhead and Salmon Unlimited
Idaho Trail Machine Association
Idaho Trails Council
Idaho Watershed Project
Idaho Weed Control Association
Idaho Wheat Commission
Idaho Wildlife Federation
Idaho Women in Timber
Idaho Wool Growers Association
Idaho-Oregon Planning and Development Association
IEDLC Forest Watch
Independence Mining Company. Inc.
Independant Forest Products Association
Indian Butte CSGD
Indian Village
Indiana Hardwood Lumbermen's Association, Inc.
Indiana Native Plant and Wildflower Society
Industrex Unlimited
Inland Empire Bank
Inland Empire Paper Company
Inland Empire Public Lands Council
Inland Empire Society of American Foresters
Inland Empire Wildlife Council
Inland Northwest Associated General Contractors
Inland Native Fish Strategy
Institute for Fisheries Resources
Institute of Environmental Studies
Integrated Management Street
Integrated Resource Management, Inc.
Interagency Lynx Committee
Intermountain Forest Industry Association
Intermountain Livestock, Inc.
International Association of Fish and Wildlife
International Paper
International Rivers Network
International Woodworkers of America
Interrain Pacific
INWARD
Irland Group
Idaho Sporting Congress
ISJ
ISPMB
ITL
Izaak Walton League of America

J

J and H Brown Logging
J and SG Investment Company
Jaca Brothers, Inc.
Jackson Guide
Jackson Hole Alliance for Responsible Planning
Jackson Hole Land Trust
Jackson Hole Ski Resort
Jackson National Fish Hatchery
Jackson Oil, Inc.
JAF
James D. King and Associates
James Wright Ranch
Japan Wood Products Information Center
Joe Keller Trucking
John Jump Trucking, Inc.
John Marshall Photography
John P. Whitted Ranches
Johnny Appleseed of Washington
Johnson Tuning Fork Ranch
Jones and Stokes Associates
Journal of Range Management
Joyce Livestock Company
JRL Ranch
J.R. Simplot Company
J.R.D. Enterprises
J.W.M. Public Lands and Natural Resource Consultants
JT Investments

K

K11 Stock Ranches
KAGO-AM/FM Radio
KAID-TV
Kalispell Area Chamber of Commerce, Montana
Kaniksu Bioregional Council
KAPP-TV
KAPS-AM
KARE-TV
KATE-TV Channel 2
KATU-TV Channel 2
KBFW-AM
KBRC-AM
KCBY-TV
KCEDA
KCHQ-TV
KCLK-Radio
KCMB-FM Radio
KCPQ-TV
KCTS-TV
KDKF-31 TV
KDRV-TV
KEA
Keerins Ranch
Kehl Ranch, Inc.
Kennecott Corporation
Kentucky Heartwood
KEPR-TV
Kettle Range Conservation Group
KEX-Radio
Keystone Center

Keystone Lumbermen's Association
KEZI-TV
KFAE-NPR Radio
KGMI-AM
KGON-AM/FM
KGRL-AM/KXIQ-FM
KGW-TV/Radio
Khalsa Therapeutic Clinic
KHQ-TV
KHSS-FM
KI-YAK RC&D
KICE-FM
KIMA-TV
KING-AM/FM
KING-TV Channels
King Blossom Orchards
King-Pierce County Farm Bureau
Kingwood Forestry Services, Inc.
Kinross Mining Company/Kinross Gold
Kinzua Corporation
Kinzua Resources, LLC
KIOK/KALE-Radio
KIRO-AM
KIRO-TC Channel 7
KISS Logging and Lumber
KIT-Radio
KIVI-TV
KJ Jump Hoisting and Hauling
KJDY-Radio
KKRT-Radio
Klamath County Flycasters
Klamath Ecosystem Education Partnership
Klamath Herald and News
KLBM-Radio
KLE Enterprises
KLXE-Radio
KMTR-TV
KMWX-Radio
KNDO-TV
KNDU-TV
Knight Forest Products, Inc.
KOBI-TV
KOHU-Radio
KOIN-Channel 6
KOMO-AM
KOMO-TV
KOMW-Radio
KONA-Radio
Koncor Forest Products
Kootenai Environmental Alliance
Kootenai Forest Congress
Kootenai Krushers
Kootenai Logyard
Kootenai Timber Land Coalition
KORD-Radio
KOTI
KOTY/KTCR-Radio
KOZE-Radio
KOZI-Radio
KPBX-FM
KPIC-TV
KPLU-FM
KPOB-FM/TV
KPQ-Radio
KPTV-TV
KPUG-KAFE
KQBE-Radio
KQIK-Radio
KRCO-AM KIJK-FM
KREM-TV
Kretz Lumber Company
KREW-Radio
KRFA-Radio/TV Center
KRLC-Radio
KSJJ Stewert Broadcasting
KSKF-FM
KSMX-AM
KSOR-FM
KSRV-Radio
KSTW-TV
KT Enterprises
KTEL-AM/FM
KTIX-KWHT News
KTRV-TV
KTUA-Radio
KTVB-TV
KTVC-TV
KTVL-TV
KTVZ-TV
KUFM-TV
KUMA/KXXM-Radio
KUPL-AM/FM
KUTI-Radio
KUZN-Radio
KVAL-TV Channel 13
KVMR Community Radio
KW3-Radio FM
KWSI-Radio
KWVR-Radio
KWWW-Radio
KXL-Radio Newsroom
KXLY-AM
KXLY-TV
KYSN-Radio
KZZR-AM

L

La Grande Chamber of Commerce, Oregon
La Grande Observer
Lake County Chamber of Commerce, Oregon
Lake County Examiner
Lakeside County Chamber of Commerce, Montana
Lakeview Lumber Products
Lalone Reforestation, Incorporated
Land Management Services

Landolt Busch and Associates
Lane County Audubon Society
Lane Livestock, Inc.
Larch Company
Larimer County Farm Bureau
Larson Logging, Inc.
Lava Nursery, Inc.
Law Environmental, Inc.
Law Fund
Law Office of Michael Hildebrand
Lazy 4W Ranch
Lazy Three S Ranch, Inc.
LEAF
League of Women Voters
Leavenworth Audubon Society
Leavenworth Echo
Lebanon Auction Yard
Legal Counseling Service of Montana
Legislative Council Bureau
Lemhi Observer
Lewis Trucking and Excavating
Lewiston Morning Tribune
Libby Area Chamber of Commerce, Montana
Libertarian Party
Liberty Logging
Liberty Northwest Insurance
Lighthawk
Lincoln Electric Cooperative, Inc.
Linehan Outfitting Company
Ling, Neilson and Robinson
Little Cattle Company
Lloyd Logging
L.M. Angus Ranch
Local Union 1136
Long Valley Advocate
Longview Associates
Longview Daily News
Longview Fibre Company
Loomis Forest Advisory Group
Los Alamos National Laboratory
Lost River Star
Louisiana-Pacific Corporation
Lower Columbia River Estuary Program
Luckow Logging, Inc.

M

Mackenzie Ranch
Madison Gallatin Alliance
Magic Valley Bowhunters Association
Magic Valley Trail Machine Association
Magic Water Company
Maibec Logging, Inc.
Malheur Enterprise
Malheur Lumber Company
Malheur Timber Operators, Inc.
Man Tech Environmental Technology, Inc.
Management Marketing Committee
Mangi Environmental
Manitoba Natural Resources
Manterola Sky Company
Manument Observatory
Mar-Jon Orchard
Marchant Ranch
Marchessace Ranch, Inc.
Marks-Miller Post and Pole, Inc.
Marshall and Associates, Inc.
Maryland Geological Survey
Mason, Bruce and Girard Incorporated
Masterson Ranch
Matson's Laboratory, LLC.
Maxim Technologies
Maxmar Consulting
McCoy Meadows Ranch
McCullough Ranch, Incorporated
McDonald Productions
McFarland North Corporation
MCFAWCP
McNamee Logging
M.E.C.
Medford Mail Tribune
Media, Inc.
Media Works
Mediation and Public Management, Inc.
Mediation Services
Meridian Oil, Inc.
Methow Forest Watch
Methow Valley Citizens Council
Methow Valley News
Metrow Washington Park Zoo
Meyers-Brown
Mid-Columbia Economic Development District
Middle Snake Group
Middle Snake Regional Water Resource Committee
Milton-Freewater Women's Improvement Club
Minerals Exploration Coalition
Minerals Resource Committee
Minnesota Timber Producers Association
Mission Farms
Mission Ridge
Missoula White Pine Sash
Missoulian
ML2042
MME Corporation
Modoc Lumber Company
Montana Agri Women
Montana Association of Counties
Montana Audubon Council
Montana Chapter Sierra Club
Montana Farm Bureau Federation
Montana for Multiple Use
Montana Historical Society
Montana Logging Association
Montana Mining Association
Montana Natural Heritage
Montana Operations Office

Montana Petroleum Association
Montana Power Company
Montana Public Lands Council
Montana Resource Providers Coalition
Montana River Action Network
Montana Society of American Foresters
Montana Standard
Montana Stockgrowers Association
Montana Tech Library
Montana Tree Farm Program
Montana Trout Unlimited
Montana Water Resources Association
Montana Wilderness Association
Montana Wildlife Federation
Montana Wood Products Association
Moore and Moore Chipping, Inc.
Morris and Wolfe Public Accountants
Morrow Brothers, Inc.
Moscow-Pullman Daily News
Mountaineers
Mount Vernon-Skagit Valley Herald
Mountain Fir Chip Company
Mountain States Legal Foundation
Mountain Vehicle Trail Riders Association
Mountain Wildlife/Northern Rockies
MRAN
Mt. Bachelor Ski Area
Mtg. Construction Corporation
MTO
Muleshoe Ranch, Inc.
Multiple Land Use Review
Munro Ranch
Murphy's Hot Springs
Musselman and Associates, Inc.
Mymac, Inc.

N

NATAPOC Resources
National Association of Conservation Districts
National Association of Counties
National Association of State Foresters
National Audubon Society
National Biological Survey
National Bison Range
National Cattlemen's Beef Association
National Council Air and Stream Improvement
National Council of the Paper Industry for Air and Stream Improvement, Inc.
National Federal Lands Conference
National Forest Foundation
National Forest Planning Committee
National Gap Coordinator
National RCA Awards
National Riparian Service Team
National Ski Areas Assoication
National Tribal Environmental Committee
National Wildlife Federation
Nationwide Forestry
Nationwide Forestry Applications Program
Native American Fish and Wildlife Society
Native American Rights Fund
Native Ecosystem Council
Native Forest Network
Native Plant Society
Natural Heritage Program
Natural Resource Committee
Natural Resource Defense Council
Nature Conservancy
NCAP
Needmor Forest Products, Inc.
Nelo Mori Ranch
Nelson Forest Region
Nevada Association of Counties
Nevada Cattlemen's Association
Nevada Landmen's Association
Nevada Mining Association
Nevada State Council of Trout Unlimited
New American
New Jersey Division of Law, CN093
New Jersey Mining Company
New Montana Exploration, Inc.
New Montana Gold Company
Newport-Miner/Gem State Miner
New York Life Insurance
New York Times
Nez Perce County Republican Central Committee
Nichols Logging, Inc.
Ninebark Forestry
Nonpoint Source Program Coordinator
North American Paleoscience
North Cascades Conservation Council
North Dakota Game and Fish
North Fork Grazing
North Fork-John Day Watershed Council
North Idaho Chamber of Commerce, Idaho
North Idaho Fly Casters
North Okanogan Resource Council
North Powder Lumber
Northern Kittitas County Tribune
Northern Regional News
Northern Rockies Biodiversity
Northern Rockies Campaign
Northern Rockies Preservation Project
Northrop, Devine and Tarbell Consulting
Northwest Ag Information Network
Northwest Cable News
Northwest Cattlemen's Association
Northwest Coalition for Alternatives to Pesticides
Northwest Council of Governments
Northwest Ecosystem Alliance
Northwest Environment Watch
Northwest Environmental Defense Center
Northwest Farmers Union
Northwest Forest Resource Council
Northwest Forestry Association

Northwest Irrigation and Soil Research Lab
Northwest Management, Inc.
Northwest Mining Association
Northwest Motorcycle Association
Northwest Natural Resources Institute
Northwest Pine Products
Northwest Power Planning Council
Northwest Public Radio
Northwest Research Institute
Northwest Timber Workers Resource Council
Northwest Watershed Research Center
NWFW

O

O and H
O.R. Travers Forestry Consultants, Inc.
Oak Ridge National Laboratory
Obsidians, Inc.
OCCED
Ochoco Resource and Recreation Association
Ochoco Lumber Company
Odell Lake Association
Office of Forestry and Ecosystem
Office of the Americas
Office of the Attorney General
Okanogan County Citizens Coalition
Okanogan Highlands Alliance
Okanogan Hound Club
Okanogan Resource Council
Oklahoma Forestry Association
Oliphant
Olympia Customer Service Center
Omak Chronicle
Omak Wood Products
OMSI Education Resource Specialist
O'Neal Forest Products
O'Neal Ranches
O'Neill Pine Company
O.P. Line, Inc.
OPBS
Oregon Cattlemen's Association
Oregon Coastal Wetlands Joint Venture
Oregon Council of Rock and Mineral Clubs
Oregon Council of Rock Hounds
Oregon Council of Trout Unlimited
Oregon Defenders of Wildlife
Oregon Economic Development Department
Oregon Environmental Council
Oregon Farm Bureau Federation
Oregon Forest Industries Council
Oregon Guides and Packers
Oregon Heritage Program
Oregon Hunter's Association
Oregon Independent Miners
Oregon Log and Fiber Company
Oregon Natural Desert Association
Oregon Natural Resources Council
Oregon Off Road Vehicle Coordinator
Oregon Public Broadcasting
Oregon Public Access Committee
Oregon Rural Development Council
Oregon Sheep Growers Association
Oregon State Shooting Association
Oregon State Snowmobile Association
Oregon Trout
Oregon Water Coalition
Oregon Water Trust
Oregon Watershed Health
Oregon Watershed Improvement Coalition
Oregon Wildlife Federation News
Oregon Women for Timber
Oregonian
Orofino Chamber of Commerce, Idaho
ORRA
O'Rorke Logging
OSF
O.T. Mining Corporation
Otley Brothers, Inc.
Our Town Publication
Outdoor Recreation Center
Outfitter and Guides Association
Owens and Hurst Lumber Company, Inc.
Owl Pharmacies, Inc.
OWP
Owyhee County Land Use Planning Committee
Owyhee Plaza
Oxarart Cattle Company

P

Pacific Biodiversity Institute
Pacific Coast Federation of Fishermen's Association
Pacific Crest Biodiversity Project
Pacific Fishery Management Council
Pacific Forest Trust
Pacific GIS
Pacific Legal Company
Pacific Legal Council
Pacific Meridian Resources
Pacific Northwest 4WD Association
Pacific Northwest Biodiversity Institute
Pacific Northwest Laboratories
Pacific Northwest Ski Areas Association
Pacific Outdoor Alliance
Pacific Power and Lights
Pacific Rivers Council
Pacificorp
Paddle Pics
Paine Wood
Palo Realty
Palouse Economic Development Council, Washington
Panhandle Health
Panhandle Trail Riders Association
Pantra
Parametrix

Parcel, Mauro, Hultin and Spaanstra
Parks and Recreation
Parsons, Behle, and Latimer
Payette Forest Watch, Inc.
Payette River Cattlemen's Association
Payne Machinery
Paz-Interfaith Peace Makers
Pegasus Gold Corporation
Pence Contracting
Pend Oreille Environmental Team
Pend Oreille Newsprint Company
Pendleton Record
Peninsula Daily News
Peninsula Environmental Center
Penta Post Company, Inc.
Pentec
People for the USA
People for the West
Perkins Coie
Peyron Ranch, Inc.
PFW-Globe-Miami
PG and E Gas Transmission Northwest
Phelps Dodge Exploration Corporation
Photoworks
PIC Technology
Picket Ranch Company
Pinchot Institute for Conservation Studies, Washington, D.C.
Pine River Lumber Company
Pine Timber Company
Pinwheel J Ranch
Pioneer Realty
PJ Taggarette Company
Plaas Timber Company
Plant Oregon
Planwest Associates
Pleasant Valley Ranch, Inc.
Pluess-Staufer
Plum Creek Lumber and Timber Company
Pocatello Trail Machine Association
Ponderay Newsprint Company
Ponderosa Newsprint
Portland Audubon Society
Portland Rotary Club
Portneuf Valley Audubon
Potlatch Corporation
Potomac Fish and Game Club, Inc.
Powder River Tackle Company
Prairie Wood Products
Predator Project
Price-Meyer Logging
Priest Basin Association
Priest River Chamber of Commerce, Idaho
Princeton Survey
Pritchard Appraisal and Farm Financial Consulting
Professional Corporation
Professional Logging Services
Psychic Horizons
Public Employees for Environmental Responsibility
Public Forestry Foundation
Public Land Users Coalition
Public Lands Council
Public Lands for People
Public Lands Foundation
Public Lands Alliance
Public Policy Research
Pugh Brothers Construction
Pulp and Paperworkers Resource Council
Putting People First
PWWYDIA
PX Cattle Company

Q

Quad City Herald
Quarter Circle BR Ranch

R

R.L. Ball Contracting
R.O. Jones and Sons
R.P. Novitzki and Associates, Inc.
Raedeke Associates, Inc.
Rafter 7 Ranch
Rain for Rent
Ramrod Gold USA
Random Lengths
Range Ecology Group
Rangelands
Rayrock Mines, Inc.
Record Courier
Red Ranch
Redfish Lake Lodge
Redmond Spokesman
Reed Logging
Regional Services, Inc.
Regulus Stud Mills, Inc.
Rensselaerville Institute
Reocan Environmental Services
Resource Organization on Timber Supply
Resources and Conservation Company
Resources for the Future
Resources Northwest, Inc.
Resources Unlimited
Resources West
Reubens Grange #333
Reynolds Logging
Rezvan Nursery
Richland Rod and Gun Club
Riddle Ranch, Inc.
Ridge Runner Forestry
Ridolfi Engineers
Riley Creek Lumber Company
Rimrock Explosives
Rimrock Valley Ranch
Rinta Farms

River City Realty
Rivers Council of Washington
Road Removal Implementation Project
Robbins Ranch
Robertson Grosswiler and Company
Robison and Associates
Rock and Arrowhead Club
Rocky Mountain Audubon Society
Rocky Mountain Elk Foundation
Rocky Mountain Log Homes
Rocky Mountain Ranches
Rogue Valley Audubon Society of Medford
Ronald E. Wright Logging, Inc.
Ross and Associates
Rotary Club of Boise, Idaho
Roundtreedt Limousine
Rouse's Home Furnishings
Rowen Ranch, Inc.
Royal British Columbia Museum
Ruby Valley Stock Association
RUST
RY Timber, Inc.
RZ Resource Consultants

S

S Martinez Livestock, Inc.
S-Cat Logging
Sacramento Internal Medicine Assoc.
Sacred Earth Foundation
Safe Alternatives For Our Forest Environment
Salmon Intermountain
Salmon River Cattlemen's Association
Salmon River Electric Co-op, Inc.
Salmon River Environmental Education and Defense
Saltman and Stevens
Sandpoint Chamber of Commerce, Idaho
Sandpoint Forest Watch
Santa Barbara Grazing Association
Santa Cruz Rainforest Action Group
Sapphire Realty
Save America's Forest
Save Chelan Alliance
Save Our Wild Salmon
Save the West
Sawmill Creek
Sawtooth Backcountry Horsemen
Sawtooth City Association, Idaho
Sawtooth Fish Hatchery
Sawtooth Science Institute
Sawtooth Wildlife Council
Sawyer Lumber Company, LLC.
Schadler Ranch, Inc.
Schellinger Construction Company, Inc.
Schumaker's Gun Shop
Schwabe Williamson
Science Application International Corporation
Scientific Certification System
SCLRC
Scotia Pacific Holding Company
Scott Peyron and Associates
SDS Lumber
Seattle Audubon Society
Seattle-Post Intelligencer
Seattle Snohomish Mill Company
Seattle Times
SEC, Inc.
Seda-Pine Beneer
Seismic Safety Products
Selkirk-Priest Basin Association
Senior Project Scientists
Sense, Inc.
Shannon and Wilson, Inc.
Shannon Environmental Services
Shapiro and Associates
Shear Artistry Hair Design
Shearer Lumber Products
Shepp Ranch
Shrub Steppe Ecosystem Lands
Sid Johnson and Company
Sierra Biodiversity Institute
Sierra Club
Sierra Club Legal Defense Fund
Silver Valley Natural Resource Trustees
Silvertip Hunting Club, Inc.
Silvics, Inc.
Simplot Land Livestock
SIS
Sisters Forest Planning Committee
Sisters of Providence
Ski Bluewood
Skyline Wheat Ranch
Smerski Logging
Snake River Audubon Society
Snow Mountain
SOAR
Society Advocating Natural Ecosystems
Society for the Protection and Care of Wildlife
Society of American Foresters
SOM Consultants
Southern Idaho Mycological Society
Southern Maine Forestry Services
Southgate Timber Company
Sowelanco
SPAWN
Spokane Audubon Society
Spokane Chamber of Commerce, Washington
Spokane Home Builders Association
Spokane Labor Council
Spokane Public Radio
Spokane Research Center
Spokesman Review
Sports Club
Spout Springs Resort
Spring-Run Chinook Salmon Workgroup
Springer Tree Farm

Springwood Associates, Inc.
Squaw Creek Irrigation District
SRS
SSI Land and Cattle Company
St. Maries Chamber of Commerce, Idaho
Stanford Livestock
Stanley/Sawtooth Chamber of Commerce, Idaho
Stanton and Associates Architects
Starker Forests, Inc.
State Historic Preservation Society
Statesman Examiner Newspaper
Statesman Journal
Stender Ranch, Inc.
Stephens Timber Consulting
Sterett Brothers
Stevedoring U.S. Pacific Coast Ports
Stevens County Cattlemen's Association
Stevens Pass, Inc.
Stewardship Logging, Inc.
Stimson Lumber Company
Stoel Reeves
Stone Container Corporation
Stone Forest Industries
Stoney Dale Press
Student Environmental Action Coalition
Sustainable Ecosystems Institute
Swan Land and Livestock
Swan View Coalition
Swank Mining District
Swanstrom Logging
Swauk Creek Sand and Gravel
Sygenex
Sylva Forest Foundation

T

T and L Ventures, Inc.
T and S Cattle
T and T Land and Timber, Inc.
T and T Logging
Tabor Creek Cattle
Tahoma Audubon Society
Tacoma Morning Tribune
Taft Logging
Tamanawit Unlimited
Tap Teal Greenway
Tate Forest
Tax Payers Association
Taylor Ranch
TBC Timber, Inc.
TD Guerin Ranch
Tecton Laminates Corporation
Telect, Incorporated
Templin Realty
Terraqua Environmental Consultants
Tetra-Tech, Inc.
The Bulletin
The Columbian
The Creek Works
The Daily Record
The Dalles Reminder
The Environmental Resource Information Center
The Everett Herald
The Glatfelter Pulp Wood Company
The Illinois Council-Trout Unlimited
The Inlander
The Lands Council
The Lane Company
The Lookout
The Louisiana Forestry Association
The Madras Pioneer
The Marker Company
The Nature Trust of British Columbia
The News Review
The Nuggett
The Observer
The Olympian
The Oman County Chronicle
The Register-Guard
The Samson Group
The Savannah Society, Incorporated
The Sisters of St. Joseph of Carondelet
The Sport Spot Sporting Goods Store
The Star News
The Sun River Sun
The Thoreau Institute
The Timber Company
The Times Journal
The Tobacco Valley Study Group
The Trust for Public Lands
The Umbrella Group
The Western News
The Weston Paper and Manufacturing Company
The Wool Bag
The World
The Write Company
Thomas Lumber Company
Thomas Reid Associates
Thompson Creek Mining
Thompson Forest Management
Thompson River Lumber Company of Montana
Three Creek Ranch Company
Three Rivers Timber, Inc.
Timber Data Company
Timber Plus
Timber Resource Management, Inc.
Timberland Management Company
Timberline Auto Center
Timberline Transport
Times-Herald
Titan Environmental Corporation
Tobacco Valley Backcountry Horseman
Tobacco Valley News
Tollefson Construction
Tom's Small Engine Shop
Tonasket Forest Watch

Tooley Creek Ranch, Inc.
Tracy Ranch
Tranquillity Ranch
Trapper Galloway Ranch
Trans-Pacific Geothermal Corporation
TRC, Mariah Association
Treasure Valley Chapter of People for the USA
Trelawny Consulting Group
Tri-Cities Herald
Tri-Cities Legislative Council
Tri-County Cattlemen's Association
Tricon Timber, Inc.
Tri-State Council
Tri-State Counties Association
Tri-State Implementation Council
Tri-State Steelheaders
Trout Creek Working Group
Trout Unlimited
Tucker Engineering Consultants
Turner Orchards
Twin Falls News

U

Umatilla Basin Watershed
Umatilla Forest Resource Council
Umbarger Ranch
Umont Mining, Inc.
Umpqua Land Exchange
Unimin Corporation
United Brotherhood of Carpenters
United Press International
United Way of Idaho
UPIY Local 712
Upper Columbia EIS Campaign
Upper Columbia Resource Council
Upper Columbia Timber/Women In Timber
Upper Columbia United Tribes Fisheries Research Center
Upper Columbia Working Group
Ureco, Incorporated
U.S.West Research
US Sheep Experiment Station
USMX
USRE Planning and Environment

V

Vaagen Brothers Lumber Company
Valley Bank of Kalispell
Valley Daily News
Valley Medical Clinic
Valley Times
Van Well Nursery
Vanderhoff Realty
Vastar Resource, Inc.
Vaux Enterprises and Exploration Company
Vermont Forest Products Association
Vernon Forest District
Versar, Inc.
Viceroy
Viewpoint Farms
Vincent Logging, Inc.
Vinson Timber Products
Virginians for Wilderness
Voice of the Environment

W

Waitsburg Times
Waldo Mining Association
Wall Street Journal
Walla Walla Basin Watershed Council
Walla Walla Chamber of Commerce, Washington
Walla Walla County Farm Bureau
Walla Walla Downtown Foundation
Walla Walla Exchange Club
Walla Walla Kiwanis
Walla Walla Union Bulletin
Wallowa County Chieftan
Wallowa County Fair Boosters, Oregon
Wallowa County Forestry Commission
Wallowa County Small Woodland
Wallowa Lake Lodge
Wallowa Mountain Zone
Wallowa Mountains Visitor Center
Wander Ranches, Inc.
Washington Agriculture Export Alliance
Washington Association of Wheat Growers
Washington Backcounty Horseman
Washington Cattlemen's Association
Washington Commercial Forest Action Committee
Washington Conservation Commission
Washington Contract Loggers Association
Washington Environmental Council
Washington Farm Bureau
Washington Farm Forestry Association
Washington Forest Protection Association
Washington Green
Washington Nature Conservancy
Washington Post
Washington Prospectors Mining Association
Washington Rangeland Committee
Washington State Association of Counties
Washington State Association of Wheat Growers
Washington State Grange
Washington State Horticulture Association
Washington State Mineral Council
Washington State Potato Commission
Washington State Snowmobile Association
Washington Trout
Washington Wilderness Coalition
Washington Women for Agriculture
Washington Women in Timber
Washington Wool Growers
Waste Policy Institute

Water For Life, Inc.
Water Forum
Water Planning Committee
Water Quality Bureau
Water Quality Workshop Group
Water Resources Division
Water Rights, Inc.
Watershed Analysis Coordination Team
Watershed Counseling
Watershed Information Center
Waterwatch of Oregon
Weiser Signal American
Wenatchee Sportsman Association
Wenatchee World
West Coast Environmental Law Association
West Mountain G and T
Westar Council
Westec
Western Ancient Forest Campaign
Western Council of Industrial Workers
Western Counties Resources Policy Institute
Western Environmental Law Center
Western Environmental Trade Association
Western Forest Economists
Western Forest Industries Association
Western Forestry Conservation Association
Western Governor's Association
Western Heritage Task Force
Western Juniper
Western Land Services
Western Legislative Forestry Task Force
Western Livestock Publications
Western Regional Air Partnership
Western Regional Office TNC
Western Resource Analysis
Western States Air Resources Council
Western States Cat
Western States Equipment
Western Utility Group
Western Watershed Analysis
Western Wood Products Association
Wetlands Woods and Wildfire Environment
Weyerhaeuser
White Mountain Coalition
Whitefish Pottery
Wilbur Register
Wild and Scenic Rivers
Wild Forever
Wilderness Society
Wildland Resources
Wildlife Management Institute
Wildlife Society
Wilenchik and Bartness Counselors at Law
Willamette Industries, Inc.
Willamette Timberman Association, Inc.
Willapa Hills Audubon Society
Windom Distributing
Winston and Cashatt
Winter-Wagner and Associates
WISH
W.K. Kellogg Foundation
WLR Publications
World Forest Institute
World Forestry Center
World Heart Medicine Care
Wolf Magazine
Women In Natural Resources
Women in Timber
Woodlands
Woods Institute
Woodward-Clyde Consultants
Woodward-Clyde International Americans
Woodward Companies
Working Assets
World Wildlife Fund
WWGA
Wyatt Jacob Engineering
Wyman Engineering Consultants
Wyoming Farm Bureau Federation
Wyoming Land and Farm Loan
Wyoming Outdoor Council
Wyoming Wildlife Federation/NRC

Y

Yaak Attack
Yaak Valley Forest Council
Yakima Herald Republic
Yakima Training Center
Yakima Valley Audubon Society
Yakima Valley Dust Dodgers Motorcycle Club

Z

Zahn Ranch
Zane Ranch
Zarnowski Logging
Ziesek Forest Service
Zone Seven
Zosel Lumber
Zubes, Inc.

Glossary

A

A1/A2 subwatershed — As defined in this EIS, refers to one of the components of the aquatic-riparian-hydrologic strategy. These areas provide a system of core subwatersheds that are the anchor for recovery and viability of widely distributed native fishes. Both A1 and A2 subwatersheds include important fish populations of one or more of the following: known strong populations for the seven key salmonids; important anadromous fish poulations in the Snake River Basin; genetically pure populations of anadromous fish ouside the Snake River Basin; and fringe populations for four of the key salmonids. A1 and A2 subwatersheds differ in their definition and their management direction, as described in Chapter 3.

Abiotic — Non-living (refers to air, rocks, soil particles, etc.).

Adaptive management — A type of natural resource management in which decisions are made as part of an ongoing process. Adaptive management involves planning, implementing, monitoring, evaluating, and incorporating new knowledge into management approaches based on scientific findings and the needs of society. Results are used to modify future management methods and policy.

Administrative unit — A management area—such as a Forest Service national forest or a BLM district, field, office, or resource area—under the administration of one line officer. Forest Service line officers include district rangers and forest supervisors; BLM line officers include district managers, field office managers, and area managers.

Air pollutant — Any substance in air that could, if in high enough concentration, harm humans, animals, vegetation, or material. Air pollutants may include almost any natural or artificial matter capable of being airborne, in the form of solid particles, liquid droplets, gases, or a combination of these.

Air quality — The composition of air with respect to quantities of pollution therein; used most frequently in connection with "standards" of maximum acceptable pollutant concentrations.

Allotment (grazing) — Area designated for the use of a certain number and kind of livestock for a prescribed period of time.

Allowable Sale Quantity (ASQ) — On a national forest, the quantity of timber that may be sold from a designated area covered by the forest plan for a specified time period.

Alluvium — General term for clay, silt, sand, or gravel deposited in the bed of a stream during relatively recent geologic time, as a result of stream action.

Alternative — In an EIS, one of a number of possible options for responding to the purpose and need for action.

Ambient air — Any unconfined portion of the atmosphere: open air and surrounding air. Often used interchangeably with "outdoor air."

Amenity — Resource use, object, feature, quality, or experience that is pleasing to the mind or senses; typically refers to values for which monetary values are not or cannot be established, such as scenic or wilderness values.

Anadromous fish — Fish that hatch in fresh water, migrate to the ocean, mature there, and return to fresh water to reproduce; for example, salmon and steelhead.

Animal Unit (AU) — Considered to be one mature cow of approximately 1,000 pounds, either dry or with calf up to 6 months of age, or their equivalent (one horse, five domestic sheep). This concept is based on a standardized amount of forage consumed.

Animal Unit Month (AUM) — The amount of feed or forage required by one animal unit grazing on a pasture for one month.

Annual (plant) — A plant whose life cycle is completed in one year or season.

Aquatic — Pertaining to water.

Aquatic ecosystem — A natural system based on a body of water (such as a stream, lake, or estuary) with its aquatic organisms and non-living components.

Aquatic Habitat Capacity — the amount and quality, relative to potential, of aquatic habitat necessary to support the numbers, sizes or age states, and life history types of salmonids that historically (approximately 250 years before present) have occurred within a subwatershed.

High - Sediment input and riparian conditions that influence the creation and maintenance of suitable habitat for salmonids and have not been substantially altered or constrained by human influences. The frequency of channel reorganizing events due to upslope activity also has not been changed. At the time of evaluation, the subwatershed supports approximately 75 to 100 percent of the potential haabitat capacity.

Moderate - Sediment input, riparian conditions, and/or the frequency of channel reorganizing events have been altered by human activities such that, at the time of evaluation, a subwatershed supports 50 to 75 percent of the potential habitat capacity.

Low - Sediment input, riparian conditions, and/or the frequency of channel reorganizing events have been altered such that, at the time of evaluation, a subwatershed supports less than 50 percent of the potential habitat capacity.

Aquatic (and riparian) health — Aquatic and riparian habitats that support animal and plant communities that can adapt to environmental changes and follow natural evolutionary and biogeographic processes. Healthy aquatic and riparian systems are resilient and recover rapidly from natural and human disturbance. They are stable and sustainable, in that they maintain their organization and autonomy over time and are resilient to stress. In a healthy aquatic/riparian system there is a high degree of connectivity from headwaters to downstream reaches, from streams to floodplains, and from subsurface to surface. Floods can spread into floodplains, and fish and wildlife populations can move freely throughout the watershed. Healthy aquatic and riparian ecosystems also maintain long-term soil productivity. Mineral and energy cycles continue without loss of efficiency.

Aquifer — Rock or rock formations (often sand, gravel, sandstone, or limestone) that contain or carry groundwater and act as water reservoirs.

Arid — Dry regions or climates that naturally lack sufficient moisture for crop production without irrigation.

Aspect — The direction the slope of a hillside or landform faces (for example, a slope with a southern aspect faces the south).

Assessment — The collection, integration, examination, and evaluation of information and values.

Attainment area — A geographic area that is in compliance with the National Ambient Air Quality Standards. An area considered to have air quality as good as or better than the national ambient air quality standards as defined in the Clean Air Act. An area may be an attainment area for one pollutant and a non-attainment area for others.

B

Band — A group of people who share a culture, territory, and sense of mutual recognition. Bands are primarily pre-treaty-making-period American Indian groups.

Bankfull width — The width of a stream channel measured between the tops of the most prominent banks on either side of the stream. Also refers to the width of the stream at the normal flood flow.

Basal area — (1) In forests, the cross-sectional area of a tree trunk measured at breast height (4.5 feet),

usually expressed in square feet per acre. (2) On rangeland, the cross-sectional area of the stem or stems of a plant or of all plants in a stand. Herbaceous and small woody plants are measured at or near the ground level; larger woody plants are measured at breast or other designated height.

Basalt — A "finely" or "fine" grained, dark, dense volcanic rock.

Basin (river) — (1) In general, the area of land that drains water, sediment, and dissolved materials to a common point along a stream channel. River basins are composed of large river systems. (2) In this EIS, the term refers to the equivalent of a 3rd-field hydrologic unit code, an area of about nine million acres, such as the Salmon River Basin. It also is used to refer to the interior Columbia River Basin assessment area (both Forest Service- and BLM-administered lands and other ownerships) as defined in the *Scientific Assessment* (Quigley and Arbelbide 1997).

Batholith — A large intrusive mass of igneous rock, usually granite.

Bayesian Belief Network (BBN) Model — A model in graphical form representing a multivariate probability distribution of random variables (Haas 1991). The graphical form of a BBN resembles a flowchart with variables (referred to as nodes) linked with arrows, representing casual influences among the variables. A BBN is directed so that influences among variables flow in one direction only, and acyclic because there are no arrows leading back to input variables. BBNs provide a quantitative framework that allows information from both empirical data and expert opinion to be combined in an evaluation process. Outcomes for each node are described by predicted levels of states, which are expressed as probabilities. For example, the state levels "Yes" (probability of occurrence = 0.65) and "No" (probability of non-occurrence = 0.35) could define a node representing a large flood event. For further information on the BBN models, see Quigley 1999.

Bedload — Sediment moving on or near a streambed.

Beneficial uses — Any of the various uses which may be made of water including, but not limited to, domestic water supplies, industrial water supplies, agricultural water supplies, navigation, recreation in and on the water, wildlife habitat, and aesthetics. The beneficial use depends on actual use, the ability of the water to support a non-existing use either now or in the future, and its likelihood of being used in a given manner. The use of water for the purpose of wastewater dilution or as a receiving water for a waste treatment facility effluent is not considered a beneficial use.

Beneficiary — The recipient for whose benefit property is held in trust.

Best Management Practices (BMPs) — Practices designed to prevent or reduce water pollution.

Biogeochemical cycle — Natural processes (biological, geological, and chemical) that recycle nutrients in various chemical forms from the environment, to organisms, then back to the environment. Examples are the carbon, nitrogen, and hydrologic cycles.

Biological crust — Thin crust of living organisms on or just below the soil surface, composed of lichens, mosses, algae, fungi, cyanobacteria, and bacteria.

Biological diversity (biodiversity) — The variety and variability among living organisms and the ecological complexes in which they occur.

Biophysical — The combination of biological and physical components in an ecosystem.

Biotic — Living.

Biotic integrity — The ability to support and maintain a balanced, integrated, adaptive community of organisms having a species composition, diversity, and functional organization comparable to that of the natural habitat of the region.

Biomass — Dry weight of organic matter in plants and animals in an ecosystem, both above and below ground.

Board foot (bf) — A unit of wood 12" x 12" x 1".

Braided stream — A stream that flows in an interconnected network of channels.

Broadcast burning — Burning forest fuels as they are, with no piling or windthrowing.

Broad scale — A large, regional area, such as a river basin and typically a multi-state area. See Chapter 2 Introduction for complete discussion and comparison to mid and fine scale.

Broad-scale species — Those species whose source habitats could be mapped reliably using a block size of at least 247 acres (100 ha.).

Browse — Twigs, leaves, and young shoots of trees and shrubs that animals eat.

Bunch grass — A grass having the characteristic growth habit of forming a bunch; lacking stolons or rhizomes.

C

Candidate species — Plant and animal species that may be proposed for listing as endangered or threatened in the future, in the opinion of the U.S. Fish & Wildlife Service (USFWS) or the National Marine Fisheries Service (NMFS). The USFWS revised its list of candidate species in the February 28, 1996 *Federal Register*. Under their new system, only those species for which they have enough information to support a listing proposal will be called candidates.

Canopy — In a forest, the branches from the uppermost layer of trees; on rangeland, the vertical projection downward of the aerial portion of vegetation.

Canopy closure — The amount of ground surface shaded by tree canopies as seen from above. Used to describe how open or dense a stand of trees is, often expressed in 10 percent increments.

Carbon cycle — The ecological cycle in which carbon moves from carbon dioxide in the air into organic materials in plants and animals, and returned to carbon dioxide through respiration, death and decay of tissues, or fire.

Carbon dioxide — A colorless, odorless gas that occurs naturally in the earth's atmosphere and is emitted into the air by fossil fuel combustion.

Carbon monoxide — A colorless, odorless, poisonous gas produced by incomplete fossil fuel combustion; primarily emitted by motor vehicles and other mobile sources. Carbon monoxide is a criteria air pollutant that interferes with the blood's ability to carry oxygen to the body's tissues and results in numerous adverse health effects.

Carnivore — An organism that eats only meat. The gray wolf is an example of a carnivore.

Carrying capacity — The number of animals or plants that can be maintained over a specific period of time on a specified amount of land without damage to either the organisms or the habitat.

Ceded lands — Lands that tribes ceded to the United States by treaty in exchange for reservation of specific land and resource rights, annuities, and other promises in the treaties.

Channel (stream) — The deepest part of a stream or riverbed through which the main current of water flows.

Channelization — Human-caused alterations to a stream channel that cause the channel to be fixed in place, such as levees, dikes, trenching, and rip-rap.

Class I area — Under the 1977 Clean Air Act amendments, all international parks, national parks larger than 6,000 acres, and national wilderness areas larger than 5,000 acres which existed on August 7, 1977. This class provides the most protection to pristine lands by severely limiting the amount of additional air pollution that can be added to these areas.

Clearcutting — A regeneration harvest method that removes all merchantable trees in a single cutting except for wildlife trees or snags. A "clearcut" is an area from which all merchantable trees have been cut.

Climate — The composite or generally prevailing weather conditions of a region throughout the year, averaged over a series of years.

Coarse Woody Debris (CWD) — Pieces of woody material derived from tree limbs, boles, and roots in various stages of decay, generally having a diameter of at least three inches and a length greater than three feet.

Collaboration — The relationship among the five federal agencies involved with ICBEMP (Forest Service, BLM, National Marine Fisheries Service, U.S. Fish and Wildlife Service, and Environmental Protection Agency) and with other federal, state, tribal, and local government officials. While shared understanding and commitment to action are the goal, and mutual or consensus agreement is considered appropriate, collaboration includes the full spectrum of involvement of the parties, such as:

- Informing - letting everyone know what each other is doing;
- Coordinating - assuring that efforts are not contradictory;
- Cooperating - making efforts complementary and synergistic;
- Mutual goal setting - mutually developing shared goals and expectations;
- Consensus - mutual support for a course of action.

Collaborative — Working together.

Commodity — Commercial article that can be bought, sold, and transported, such as mining, agricultural, timber, or other forest products.

Community — (1) A group of species of plants and/ or animals living and interacting at a particular time and place. (2) A group of people residing in the same place and under the same government; spatially defined places such as towns.

Community of interest — People who share a common concern but may not be located in the same place.

Compaction — Making soil hard and dense, decreasing its ability to support vegetation because the soil can hold less water and air and because roots have trouble penetrating the soil.

Competition — An interaction that occurs when two or more individuals make demands of the same resources that are in short supply.

Component — A part of a system.

Composition (species) — The mix of different species that make up a plant or animal community, and their relative abundance.

Connectivity — The arrangement of habitats that allows organisms and ecological processes to move across the landscape; patches of similar habitats are either close together or linked by corridors of appropriate vegetation. The opposite of fragmentation.

Conservation strategy/conservation agreement — Plans to remove or reduce threats to candidate and sensitive species of plants and animals so that a listing as threatened or endangered is unnecessary.

Consultation — (1) An active, affirmative process that (a) identifies issues and seeks input from appropriate American Indian governments, community groups, and individuals; and (b) considers their interests as a necessary and integral part of the BLM's and Forest Service's decision-making process. (2) The federal government has a legal obligation to consult with American Indian tribes. This legal obligation is based in such laws as NAGPRA, AIRFA, and numerous other executive orders and statutes. This legal responsibility is, through consultation, to consider Indian interests and account for those interests in the decision. (3) The term also refers to a requirement under Section 7 of the Endangered Species Act for federal agencies to consult with the U.S. Fish and Wildlife Service and/or National Marine Fisheries Service with regard to federal actions that may affect listed threatened and endangered species or critical habitat.

Corridor (landscape) — Landscape elements that connect similar patches of habitat through an area with different characteristics. For example, streamside vegetation may create a corridor of willows and hardwoods between meadows or through a forest.

Cover — (1) Trees, shrubs, rocks, or other landscape features that allow an animal to partly or fully conceal itself. (2) The area of ground covered by plants of one or more species.

Cover type — A vegetation classification depicting a genus, species, group of species, or life form of tree, shrub, grass, or sedge. The present vegetation of an area.

Criteria pollutants — Air pollutants designated by the Environmental Protection Agency (EPA) as potentially harmful and for which ambient air standards have been set to protect the public health and welfare. The criteria pollutants are carbon monoxide, sulfur dioxide, particulate matter, nitrogen dioxide, ozone, hydrocarbons, and lead.

Crown — The part of a tree containing live foliage; treetops.

Crown fire — A forest fire that burns in the crowns of trees.

Cultural resources — Nonrenewable evidence of human occupation or activity as seen in any area, site, building, structure, artifact, ruin, object, work of art, architecture, or natural feature, which was important in human history at the national, state, or local level.

Cumulative effects — Impacts on the environment that result from the incremental impact of an action when added to other past, present, and reasonably foreseeable future actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time. In this EIS, potential cumulative effects include those that were assessed for all ownerships, including lands administered by other federal agencies and non-federal lands, especially regarding terrestrial and aquatic species.

Current period — In this EIS, generally depicts conditions in the project area representative of the period between 1985 and 1995, approximately.

D

Data — Facts used in an analysis.

Debris (organic) — Logs, trees, limbs, branches, leaves, bark, etc., that accumulate, often in streams or riparian areas.

Decay (decomposition) — The breakdown of organic matter, usually as a result of bacterial or fungal actions.

Degradation — (1) General lowering of the earth's surface by erosion or moving of materials from one place to another. (2) Reduction in value or quality.

Degrade (habitats) — Measurably change a feature at a defined scale in a way that: further reduces habitat quality, where existing conditions meet or are worse than the objective; reduces habitat quality, where existing conditions are better than the objective.

De minimis — Very small or of little significance.

Demographic — Related to the vital statistics of human populations (size, density, growth, distribution, etc.) and the effect of these on social and economic conditions.

Density (stand) — The number of trees growing in a given area, usually expressed in terms of trees per acre.

Developed recreation — Recreation that requires facilities that in turn result in concentrated use of an area; for example, a campground.

Direct effects — Impacts on the environment that are caused by the action and occur at the same time and place.

Dispersed recreation — Recreation that does not occur in a developed recreation site; for example, hunting or backpacking.

Disturbance — Refers to events that alter the structure, composition, or function of terrestrial or aquatic habitats. Natural disturbances include, among others, drought, floods, wind, fires, wildlife grazing, and insects and diseases. Human-caused disturbances include, among others, actions such as timber harvest, livestock grazing, roads, and the introduction of exotic species.

Disturbance-recovery regime — Natural pattern of periodic disturbances, such as fire or flood, followed by a period of recovery from the disturbance (such as regrowth of a forest after fire).

Diversity — See biological diversity.

Dominant — A group of plants that by their collective size, mass, or number exert a primary influence on other ecosystem components.

Downed wood — A tree or part of a tree that is dead and laying on the ground.

Duff — The partially decomposed organic material of the forest floor that lies beneath freshly fallen leaves, needles, twigs, stems, bark, and fruit.

Drought — In reference to rangeland, a period without precipitation during which the soil water content is reduced to such an extent that plants suffer from lack of water. A drought year, in this EIS, refers to less than or equal to 75 percent of normally received precipitation in a year.

Dynamic equilibrium — A system that is maintained in a harmonious and integrated condition while continuous change, activity, or progress occurs.

E

Eastside Screens — Interim management direction establishing riparian, ecosystem, and wildlife standards for timber sales on Forest Service-administered lands in eastern Oregon and Washington.

Ecological integrity — In general, ecological integrity refers to the degree to which all ecological components and their interactions are represented and functioning; the quality of being complete; a sense of wholeness. Absolute measures of integrity do not exist. Proxies provide useful measures to estimate the integrity of major ecosystem components (forestland, rangeland, aquatic, and hydrologic). Estimating these integrity components in a relative sense across the project area helps to explain current conditions and to prioritize future management. Thus, areas of high integrity would represent areas where ecological functions and processes are better represented and functioning than areas rated as low integrity. In this EIS, ecological integrity is used to show the integrated condition of the biophysical environment within the project area.

Ecological processes — The flow and cycling of energy, materials, and organisms in an ecosystem. Examples of ecosystem processes discussed in this EIS include the carbon and hydrologic cycles, terrestrial and aquatic food webs, and plant succession, among others.

Ecological Reporting Unit (ERU) — In this EIS, a geographic mapping unit developed by the Science Integration Team to report information on the description of biophysical environments, the characterization of ecological processes, the discussion of past management activities and their effects, and the identification of landscape management opportunities.

Ecological significance — In the *Scientific Assessment* and this EIS, refers to a specific method of judging the significance of changes (from historical) of cover types and terrestrial community types, based on class changes, regional changes, and departure indices. See Hann, Jones, Karl, et al. (1997, page 409) for details.

Ecology — the science of the interrelationships between organisms and their environment; from the Greek *Oikos* meaning "house" or "place to live."

Economically specialized community — A community whose employment in one or more industry groups (for example, agriculture, mining, construction, or manufacturing), as a percentage of total community employment, is greater than the same percentage for the economic subregion in which the community is located. For instance, if the jobs in a particular industry group in the economic subregion make up 5 percent of total employment, but the jobs in the local community in that industry account for 10 percent of total community employment, the community would be considered economically specialized in that industry. (See Reyna 1998 for more detail on determining economic specialization.)

Economic efficiency — Producing goods and services in areas best suited for that production based on natural biophysical advantage or an area's ability to best serve regional demands of people.

Economic region — A group of communities and their surrounding rural areas that are linked together through trade.

Economy — System of production, distribution, and consumption of economic goods.

Ecosystem — A complete, interacting system of living organisms and the land and water that make up their environment; the home places of all living things, including humans.

Ecosystem health — A condition where the parts and functions of an ecosystem are sustained over time and where the system's capacity for self-repair is maintained, such that goals for uses, values, and services of the ecosystem are met.

Ecosystem-based management — The use of an ecological approach to achieve multiple-use management of public lands by blending the needs of people and environmental values in such a way that Forest Service and BLM lands represent diverse, healthy, productive, and sustainable ecosystems.

Ecotone — A boundary or zone of transition between adjacent communities or environments, such as the boundary between a forest and a meadow or the boundary of a clearcut next to a mature forest stand. Species present in an ecotone are intermixed subsets of the adjacent communities.

Edge effect — The influence of two communities on populations in their adjoining boundary zone or ecotone, affecting the composition and density of the populations in these bordering areas.

Emergent (tree) — Live or dead tree that is taller than the overall stand and thus emerges above the rest. Emergent trees are important to many wildlife species that use forest stand-initiation structural stages.

Emission — A release of air contaminants into the outdoor atmosphere.

Endangered species — A plant or animal species listed under the Endangered Species Act that is in danger of extinction throughout all or a significant portion of its range.

Endemic species — Plants or animals that occur naturally in a certain region and whose distribution is relatively limited to a particular locality. "Endemism" is the occurrence of endemic species in an area.

Environment — The combination of external physical, biological, social, and cultural conditions affecting the growth and development of organisms and the nature of an individual or community.

Environmental Impact Statement (EIS) — A statement of environmental effects of a proposed action and alternatives to it. A Draft EIS is released to the public and other agencies for review and comment. A Final EIS is issued after consideration of public comments. A Record of Decision (ROD) is based on the information and analysis in the Final EIS.

Environmental Index — A measure of the capability of a watershed or subwatershed to support a species.

Environmental Outcome (terrestrial species) — A characterization of outcome, based on habitat capacity, range extent, and connectivity. See Chapter 4, Terrestrial Species Component, for a complete discussion.

Epidemic (outbreak) — The rapid spread, growth, and development of diseases or insect populations that affect large numbers of a host population throughout an area at the same time.

Erosion — The wearing away of the land surface by running water, wind, ice, gravity, or other geological activities; can be accelerated or intensified by human activities that reduce the stability of slopes or soils.

Ethno-habitats — Habitats that are socially and/or traditionally important to American Indian cultures.

Eutrophication — Changes that occur in a lake or other body of water due to excessive supplies of nutrients such as nitrates and phosphates, usually from runoff from the surrounding land.

Evapotranspiration — The actual total loss of water by evaporation from soil, water bodies, and transpiration from vegetation, over a given area with time.

Even-aged management — Method of forest management in which trees, usually of a single species, are maintained at about the same age and size and are harvested all at once so a new stand may grow.

Even-aged stands — Stands of trees of approximately the same age. Silvicultural methods that generate even-aged stands include clearcutting, shelterwood, and seed tree.

Excessive livestock grazing pressure — Grazing pressure that results in a decline in physiological vigor of plants, typically observed as a decline in reproductive output (for example, seeds and rhizomes) and growth, both above ground (for example, tiller production of grasses) and below ground (for example, root growth). This decline in physiological vigor results in decreased ability of the plant to compete for resources and results in alteration of plant species composition in plant communities. The connotation of this phrase is negative.

Exotic — A plant or animal species introduced from a distant place; not native to the area.

Extinction — Complete disappearance of a species from the earth.

Extirpation — Loss of populations from all or part of a species' range within a specified area.

F

Fauna — The vertebrate and invertebrate animals of an area or region.

Federal Land Policy and Management Act (1976) (FLPMA) — The act that establishes public land policy primarily for the Bureau of Land Management; establishes guidelines for its administration; and provides for the management, protection, development, and enhancement of the public lands, among other provisions.

Fines (sediment) — Sediment particles smaller than 0.2 inch. Excessive fines can trap newly hatched fish and decrease the amount of water percolating through spawning gravels. High fine sediment loads slow plant growth and reduce available food, oxygen, and light.

Fine scale — A single landscape, such as a watershed or subwatershed. See Chapter 2 Introduction for a complete discussion and comparison to broad and mid scale.

Fine-scale species — Those species whose source habitats could not be mapped reliably using a block size of at least 247 acres (100 ha.).

Fire-dependent systems — Forests, grasslands, and other ecosystems historically composed of species of plants that evolved with and are maintained by fire regimes.

Fire cycle, fire frequency — See fire return interval.

Fire-independent system — Forests, grasslands, and other ecosystems whose primary natural disturbances historically were decomposition, windthrow, flooding, or other disturbances other than fire.

Fire-intolerant — Species of plants that do not grow well with or die from the effects of too much fire. Generally these are shade-tolerant species.

Fire regime — The characteristics of fire in a given ecosystem, such as the frequency, predictability, intensity, and seasonality of fire.

Fire return interval — The average time between fires in a given area.

Fire-tolerant — Species of plants that can withstand certain frequency and intensity of fire. Generally these are shade-intolerant species.

Floodplain — The portion of a river valley or level lowland next to streams which is covered with water when the river or stream overflows its banks at flood stage.

Forage — Vegetation (both woody and non-woody) eaten by animals, especially grazing and browsing animals.

Forbs — Broad-leafed plants; includes plants that commonly are called weeds or wildflowers.

Forest health — The condition in which forest ecosystems sustain their complexity, diversity, resiliency, and productivity toprovide for specified human needs and values. It is a useful way to communicate about the current condition of the forest, especially with regard to resiliency, a part of forest health that describes the ability of the ecosystem to respond to disturbances. Forest health and resiliency can be described, in part, by species composition, density, and structure.

Forest plan (Forest Land and Resource Management Plan) — A document that guides natural resource management and establishes standards and guidelines for a national forest; required by the National Forest Management Act.

Fragmentation (habitat) — The break-up of a large land area (such as a forest) into smaller patches isolated by areas converted to a different land type. The opposite of connectivity.

Fringe environments — Those environments at the extreme edges of a species' distribution.

Fry — A recently hatched fish, after the yolk sac has been absorbed.

Fuel (fire) — Dry, dead parts of trees, shrubs, and other vegetation that can burn readily.

Fuel ladder — Vegetative structures or conditions such as low-growing tree branches, shrubs, or smaller trees that allow fire to move vertically from a surface fire to a crown fire.

Fuel load — The dry weight of combustible materials per unit area; usually expressed as tons per acre.

G

Game species — Wild animals that people hunt or fish for food or recreation according to prescribed seasons and limits.

Gene pool — All the genetic (hereditary) information contained in a reproducing population of a particular species.

Genetic adaptation — Changes in the genetic makeup of organisms that allow the species to gain a competitive reproductive and survival advantage under changed environmental conditions.

Genetic integrity — Gene complexes that have evolved together and are characteristic of locally adapted species.

Geoclimatic setting — The geology, climate (precipitation and temperature), vegetation, and geologic processes (such as landslides or debris flows) that are characteristic of a place; places with similar characteristics are said to have the same geoclimatic setting.

Geographic Information System (GIS) — An information processing technology to input, store, manipulate, analyze, and display data; a system of computer maps with corresponding site-specific information that can be combined electronically to provide reports and maps.

Geologic/geomorphic processes — The actions or events that shape and control the distribution of materials, their states, and their morphology, within the interior and on the surface of the earth. Examples of geologic processes include: volcanism, glaciation, streamflow, metamorphism (partial melting of rocks), and landsliding.

Geomorphology — The geologic study of the shape and evolution of the earth's landforms.

Glacial till — Mixed rock of clay, sand, gravel, and boulders transported and deposited by glaciers.

Glaciation — Alteration of the earth's solid surface through erosion and deposition by glacier ice.

Goals (management) — In this EIS, refers to descriptions of what an agency wants to accomplish.

Gradient — A rate of vertical elevation change per unit of horizontal distance; also called slope.

Grazing pressure — The ratio of forage demand to forage available, for any specified forage, at any point in time. (Thus, as forage demand increases relative to forage available, grazing pressure increases, and vice-versa.)

Greenstripping — The practice of planting strips of fire-resistant vegetation at strategic locations on the landscape to slow or stop wildfires.

Ground fire — A fire that burns the organic material in the soil layer and the decayed material or peat below the ground surface.

Groundwater — Water that sinks into the soil and is stored in slowly flowing and slowly renewed underground reservoirs called aquifers.

Guideline (management) — In this EIS, refers to suggested action, priority, process, or prescription that may be useful in meeting objectives; not required.

H

Habitat — A place that provides seasonal or year-round food, water, shelter, and other environmental conditions for an organism, community, or population of plants or animals.

Habitat capacity — A weight-averaged environmental index in which the weights are the areas of each hydrologic unit code (HUC). The weight average is presented in this EIS as a percentage of historical weight-average.

Habitats that have declined substantially in geographic extent from the historical to the current period — Those cover type-structural stage combinations that have declined by more than 20 percent in more than half of the ecological reporting units (ERUs) where the historical extent is 50 percent of the ERU area or greater and where the overall net change in extent from historical to current periods is negative.

Habitat type — A group of plant communities having similar habitat relationships.

Harvest — (1) Felling and removal of trees from the forest; (2) removal of game animals or fish from a population, typically by hunting or fishing.

Harvestable/harvestability — In this EIS, with regard to American Indian tribes, refers to a population of plants or animals that is self-sustaining and capable of producing a dependable harvest annually to meet spiritual, cultural, subsistence, and commercial needs.

Haziness — A reduction in viewing distance and ability to detect finer features on the landscape.

Headwaters — Beginning of a watershed; unbranched tributaries of a stream.

Herbaceous — Green and leaf-like in appearance or texture; includes grasses, grass-like plants, and forbs, with little or no woody component.

Herbivore — An animal that subsists on plants or plant materials, either primarily or entirely.

Hierarchy — (1) A ranked or graded series; (2) a sequence of items nested within each other, each smaller than and included within the previous one.

High quality waters — Waters whose quality is necessary to support threatened, endangered, proposed, candidate, and sensitive species restoration, conservation, or recover; waters/watersheds used as sources of public drinking water; waters/watersheds where groundwater recharge to Sole Source Aquifers is designated under the Safe Drinking Water Act; and waters whose quality is necessary to support all designated beneficial uses.

High restoration priority subbasins — Subbasins identified by the ICBEMP as high priority for restoration at the broad scale, where management intent is to concentrate restoration efforts (such as aquatic, water quality, vegetation management, or reestablishing fire) and to make restoration activities more effective and efficient.

Historical period — In this EIS, refers to information recorded during the early decades of Euroamerican settlement of the interior Columbia River Basin, approximately the mid 1800s, prior to major changes caused by this settlement and by subsequent patterns of land and resource use.

Historical Range of Variability (HRV) — The natural fluctuation of ecological and physical processes and functions that would have occurred during a specified period of time. In this EIS, refers to the range of conditions that are likely to have occurred prior to settlement of the project area by Euroamericans (approximately the mid 1800s), which would have varied within certain limits over time. HRV is discussed in this document only as a reference point, to establish a baseline set of conditions for which sufficient scientific or historical information is available to enable comparison to current conditions.

Home range — The area around an animal's established home which is visited during the animal's normal activities.

Homogeneous — Regular, similar; uniform throughout.

Hybridization — The cross-breeding of unlike individuals to produce hybrid offspring.

Hydrologic — Refers to the properties, distribution, and effects of water. "Hydrology" refers to the broad science of the waters of the earth—their occurrence, circulation, distribution, chemical and physical properties, and their reaction with the environment.

Hydrologic cycle (water cycle) — The ecological cycle that moves water from the air by precipitation to the earth and returns it to the atmosphere; a variety of processes are involved, including evaporation, run-off, infiltration, percolation, storage, and transpiration.

Hydrologic unit code (HUC) — A hierarchical coding system developed by the U.S. Geological Survey to identify geographic boundaries of watersheds of various sizes.

Hydrophobic (soil) — A condition in which soil becomes water-repellant, the capacity of soil to hold water is reduced, and chances for erosion are increased.

Hydrophytic plants — Plants that grow wholly or partly immersed in water.

I

Igneous rocks — Rocks formed by molten lava becoming solid.

Impermeable — Cannot be penetrated.

Implement — To carry out.

Indicator species — A species that is presumed to be sensitive to habitat changes; population changes of indicator species are believed to best indicate the effects of land management activities.

Indirect effects — Impacts on the environment that are caused by the action and are later in time or farther removed in distance but are still reasonably foreseeable.

Infiltration — The movement of water through soil pores and spaces.

INFISH — Interim Inland Native Fish Strategy for the Intermountain, Northern, and Pacific Northwest Regions (Forest Service).

Infrastructure — The basic facilities, equipment, and installations needed for the functioning of a system; commonly refers to such items as roads, bridges, power facilities, and the like.

In-migration — The movement of new residents into an area.

Instream flow — Flow of water in its natural setting (as opposed to waters diverted for 'off-stream' uses such as industry or agriculture). Instream flow levels provided for environmental reasons enhance or maintain the habitat for riparian and aquatic life, with timing and quantities of flow characteristic of the natural setting.

Integration — Bringing the values and systems of different disciplines together to address policy questions with a common framework using consistent techniques and measurement units.

Interagency — Involving Forest Service, BLM, and other federal agencies.

Intergovernmental — Involving federal, state, tribal, county, or other government entities.

Intermittent stream — A stream that flows only at certain times of the year when it receives water from other streams or from surface sources such as melting snow.

Integrity — See ecological integrity.

Invasion (plant) — The movement of a plant species into a new area outside its former range.

Invertebrate — Small animals that lack a backbone or spinal column. Spiders, insects, and worms are examples of invertebrates.

Irretrievable commitment — A term that applies to losses of production or commitment of renewable natural resources. For example, while an area is used as a ski area, some or all of the timber production there is "irretrievably" lost. If the ski area closes, timber production could resume; therefore, the loss of timber production during the time the area is devoted to skiing is irretrievable but not irreversible, because it is possible for timber production to resume if the area is no longer used as a ski area.

Irreversible commitment — A term that applies to non-renewable resources, such as minerals and archaeological sites. Losses of these resources cannot be reversed. Irreversible effects can also refer to effects of actions on resources that can be renewed only after a very long period of time, such as the loss of soil productivity.

Isolated community — A community located more than 35 to 50 miles from any town with a population greater than 9,000. Communities with populations between about 1,900 and 9,000 are referred to as "isolated trade centers." (See Reyna 1998 for additional details on how isolated communities were specified.)

Issue — A matter of controversy, dispute, or general concern over resource management activities or land uses. To be considered a "significant' environmental impact statement issue, it must be well defined, relevant to the proposed action, and within the ability of the agency to address through alternative management strategies.

L

Landscape — All the natural features such as grasslands, hills, forest, and water, which distinguish one part of the earth's surface from another part; usually that portion of land which the eye can comprehend in a single view, including all its natural characteristics.

Landscape composition — The types of stands or patches present across a given area of land.

Landscape ecology — The study of the ecological effects of spatial patterns in ecosystems.

Landscape structure — The mix and distribution of stand or patch sizes across a given area of land. Patch sizes, shapes, and distributions are a reflection of the major disturbance regimes operating on the landscape.

Large downed wood — Logs on the forest floor with a large end diameter of at least 21 inches.

Large snag — A standing dead tree with a diameter at breast height of at least 21 inches.

Large woody debris — Pieces of wood that are of a large enough size to affect stream channel morphology.

Lethal (stand-replacing) fires — In forests, fires in which less than 20 percent of the basal area or less than 10 percent of the canopy cover remains; in rangelands, fires in which most of the shrub overstory or encroaching trees are killed.

Lichens — Organisms made up of specific algae and fungi, forming identifiable crusts on soil, rocks, tree bark, and other surfaces. Lichens are primary producers in ecosystems; they contribute living material and nutrients, enrich the soil and increase soil moisture-holding capacity, and serve as food sources for certain animals. Lichens are slow-growing and sensitive to chemical and physical disturbances.

Lifeways — The manner and means by which a group of people lives; their way of life. Components include language(s), subsistence strategies, religion, economic structure, physical mannerisms, and shared attitudes.

Likelihood of persistence — A relative measure of risk (developed by the EIS Team, related to changes in habitat conditions) to the continued distribution of species in a Terrestrial Family on Forest Service- and BLM-administered lands. Three relative rating levels were used: good, fair, or poor; a rating is established for a Family based on the predicted effects on modeled species in that Family. See Chapter 4, Terrestrial Species Component, for a complete discussion.

Litter — The uppermost layer of organic debris on the soil surface, which is essentially the freshly fallen or slightly decomposed vegetation material such as stems, leaves, twigs, and fruits.

Long term — Generally refers to a period longer than 10 years. In Chapter 4 of this EIS, refers to the period evaluated by the Science Advisory Group, either at 100 years ('long term') or over an average of 10 decades into the future ('long term average').

Lower montane — A terrestrial community that generally is found in drier and warmer environments than the montane terrestrial community. The lower montane community supports a unique clustering of wildlife species.

M

Mainstem — The main channel of the river in a river basin, as opposed to the streams and smaller rivers that feed into it.

Maintain — (1) To continue. (2) For this document, the term is intended to convey the idea of keeping ecosystem functions, processes, and/or components (such as soil, air, water, vegetation) in such a condition that the ecosystem's ability to accomplish current

and future management objectives is not weakened. Management activities may be compatible with ecosystem maintenance if actions are designed to maintain or improve current ecosystem condition.

Management direction — A statement of goals and objectives, management prescriptions, and associated standards and guidelines for attaining them.

Mass movement, mass wasting (erosion) — Large land slump, where a mass of rock or soil slips in one large unit down from a cliff or slope.

Merchantable timber — Timber that can be bought or sold.

Microbes — Microscopic organisms such as fungi, bacteria, or algae.

Microbiotic crust — See Biological Crust.

Microclimate — The climatic conditions within a small habitat such as: a tree stump, under a boulder, in the space between grasses, or on the side of a slope.

Mid scale — A subregional area, such as a group of contiguous subbasins. See Chapter 2 Introduction for a complete discussion and comparison to fine and broad scale.

Migration corridor — The habitat pathway an animal uses to move from one place to another.

Minimize — Apply best available technology, management practices, and scientific knowledge to reduce the magnitude, extent, and/or duration of impacts.

Mitigation — Measures designed to counteract environmental impacts or to make impacts less severe.

Mixed stand — A stand consisting of two or more tree species.

Mixing height — Measured from the surface upward. The height to which relatively vigorous mixing of air due to convection occurs.

Monitoring — A process of collecting information to evaluate whether or not objectives of a project and its mitigation plan are being realized. Monitoring allows detection of undesirable and desirable changes so that management actions can be modified or designed to achieve desired goals and objectives while avoiding adverse effects to ecosystems.

Monoculture — A plant community (forest, range) consisting of only one species; uniform throughout.

Montane — A terrestrial community that generally is found in moderate environments between the lower montane (ponderosa pine) and subalpine terrestrial communities. Montane communities are generally moister than lower montane and warmer than subalpine, and support a unique clustering of wildlife species.

Morphology — Form and structure.

Mosaic — A pattern of vegetation in which two or more kinds of communities are interspersed in patches, such as clumps of shrubs with grassland between.

Multiple-use management — The management philosophy articulated by the Multiple Use-Sustained Yield Act of 1960. This law provides that the renewable resources of the national forests are to be managed in the combination that best meets the needs of the American people. It further stipulates that the Forest Service is to make judicious use of the land for some or all of these resources and related services over areas large enough to ensure that sufficient latitude exists to subsequently adjust management in conformity with changing needs and condidtions. The Federal Land Policy and Management Act provides similar direction for the BLM.

Mycorrhizae — The symbiotic relationship between certain fungi and the roots of certain plants, especially trees; important for plants to take nutrients from soil.

N

National Ambient Air Quality Standards (NAAQSs) — Standards set by the Federal Environmental Protection Agency for the maximum levels of air pollutants that can exist in the outdoor air without unacceptable effects on human health or the public welfare.

National Environmental Policy Act (NEPA) — An act of Congress passed in 1969 declaring a national policy to encourage productive and enjoyable harmony between people and the environment, to promote efforts that will prevent or eliminate damage to the environment and the biosphere and stimulate the health and welfare of people, and to enrich the understanding of the ecological systems and natural resources important to the nation, among other purposes.

National Forest Management Act (NFMA) — A law passed in 1976 requiring the preparation of Forest

Service regional guides and forest plans and the preparation of regulations to guide that development.

Native species — Species that normally live and thrive in a particular ecosystem.

Natural areas — Areas managed by various landowners that are mainly in a natural state and being managed to maintain or restore a degree of naturalness for research, monitoring, inventory, habitat protection, education, or social needs.

Natural resources — Water, soil, wild plants and animals, air, minerals, nutrients, and other resources produced by the earth's natural processes.

Natural scenic condition — Naturally appearing or only slightly altered, determined by using scenery management system methods described in the USDA Agriculture Handbook 701.

New action — Those actions that have not been implemented, or for which contracts have not been awarded, or for which permits have not been issued. (See ongoing action.)

Niche — The smallest unit of a habitat occupied by an organism, and/or the role of an organism in the environment.

Nitrogen cycle — Cyclic movement of nitrogen in different chemical forms from the environment, to organisms, and then back to the environment.

Nitrogen-fixing — Ability to remove nitrogen from the atmosphere and convert it to forms that can be used by plants, animals, and microbes. Very few specialized organisms have this ability, making them critical to the nitrogen cycle.

No-action alternative — The most likely condition expected to exist in the future if current management direction were to continue unchanged.

Nongame — Term for wild animals not commonly harvested for recreation, fur, food, or subsistence.

Nonlethal fire — In forests, fires in which more than 70 percent of the basal area or more than 90 percent of the canopy cover survives; in rangelands, fires in which more than 90 percent of the vegetative cover survives (implies that fire is occurring in an herbaceous-dominated community).

Non-point source pollution — Pollution whose source is not specific in location; the sources of the pollutant discharge are dispersed, not well defined or constant. Examples include sediments from logging activities and runoff from agricultural chemicals.

Non-vascular plants — Plants that do not have vessels or ducts to conduct water and food and therefore require a moist environment for survival; mosses and liverworts are examples of non-vascular plants.

Noxious weed — A plant species designated by federal or state law as generally possessing one or more of the following characteristics: aggressive and difficult to manage; parasitic; a carrier or host of serious insects or disease; or non-native, new, or not common to the United States. According to the Federal Noxious Weed Act (PL 93-639), a noxious weed is one that causes disease or has other adverse effects on man or his environment and therefore is detrimental to the agriculture and commerce of the United States and to the public health.

Nutrient cycles — Ecological processes in which nutrients and elements such as carbon, phosphorous, nitrogen, calcium, and others, circulate among animals, plants, soils, and air.

O

Objective (management) — In this EIS, indicates short-term (10 years or less) and/or long-term (longer than 10 years) outcome(s) that is (are) expected or desired. Objectives are more specific than goals, and they focus primarily on conditions or processes we are trying to achieve or prevent rather than on specific actions or restrictions. Whenever possible, time periods expected to attain the outcome are specified.

Old forest — (a) *Old single story forest* refers to mature forest characterized by a single canopy layer consisting of large or old trees. Understory trees are often absent, or present in randomly spaced patches. It generally consists of widely spaced, shade-intolerant species, such as ponderosa pine and western larch, adapted to a nonlethal, high frequency fire regime. (b) *Old multi-story forest* refers to mature forest characterized by two or more canopy layers with generally large or old trees in the upper canopy. Understory trees are also usually present, as a result of a lack of frequent disturbance to the understory. It can include both shade-tolerant and shade-intolerant species, and is generally adapted to a mixed fire regime of both lethal and nonlethal fires. Other characteristics of old forests include: variability in tree size; increasing numbers of snags and coarse woody debris; increasing appearance of decadence, such as broken tops,

sparse crowns, and decay in roots and stems; canopy gaps and understory patchiness; and old trees relative to the site and species. See Appendix 17 for details.

Omnivore — An animal that eats a combination of meat and vegetation. Grizzly bears and humans are examples of omnivores.

Ongoing actions — Those actions that have been implemented, or have contracts awarded or permits issued. (See new actions.)

Outcome (terrestrial species) — A characterization of the likely distribution and relative abundance of each species across its range in the project area. Two types of outcome are reported in the EIS: environmental outcomes and population outcomes. See Chapter 4, Terrestrial Species Component, for complete discussion.

Outcome-based objectives — Objectives that focus on conditions or processes to achieve or prevent, rather than on specific actions or restrictions.

Out-migration — The movement of former residents away from an area.

Overfishing — Harvesting of so many fish of a species, especially immature ones, that there is not enough breeding stock left to replenish the species.

Overgrazing — Consumption of rangeland grass by grazing animals to the point that it cannot be renewed, or can be only slowly renewed, because of damage to the root system.

Overstory — The upper canopy layer.

Ozone — A strong smelling, pale blue, reactive toxic chemical gas consisting of three oxygen atoms. A pollutant formed in the atmosphere which can seriously affect the human respiratory system.

P

PACFISH — Interim Strategies for Managing Pacific Anadromous Fish-producing Watersheds in Eastern Oregon and Washington, Idaho, and Portions of California.

Park-like stand — Stand having scattered large overstory trees, few or no understory trees, and open growing conditions usually maintained by frequent ground fires.

Particulates — Solid particles or liquid droplets suspended or carried in the air.

Patch — An area of uniform vegetation that differs from what surrounds it in structure and composition. Examples might include a patch of forest surrounded by a cut-over area or a patch of dense young forest surrounded by a patch of open old forest.

Pathogen — An agent such as a fungus, virus, or bacterium that causes disease.

Pattern — The spatial arrangement of landscape elements (patches, corridors, matrix) that determines the function of a landscape as an ecological system.

Percolation — The oozing or draining of water through fine, porous soil surfaces.

Perennial — A plant that lives for three or more years.

Physiography — Pertains to the study of the formation and evolution of landforms.

PILT (Payments in Lieu of Taxes) — Payments made to counties by the Forest Service to mitigate losses to counties because public lands cannot be taxed.

Planning area — In this EIS, refers to either the UCRB EIS area or the Eastside EIS area, as defined in the UCRB and Eastside Draft EISs. Together the two planning areas are referred to as the 'project area'.

PM_{10} — Particulate matter that measures 10 micrometers in diameter or less, a size considered small enough to invade the alveolar regions of the lung. PM_{10} is one of the six pollutants for which there is a national ambient air quality standard.

Point source pollution — Pollution that comes from a single identifiable source such as a smokestack, a sewer, or a pipe.

Pool — Portion of a stream where the current is slow, often with deeper water than surrounding areas and with a smooth surface texture. Often occur above and below riffles and generally are formed around stream bends or obstructions such as logs, root wads, or boulders. Pools provide important feeding and resting areas for fish.

Pool attributes — Characteristics of a pool such as its depth, width, and surface texture.

Population outcome (terrestrial species) — A characterization of outcome, based on habitat capacity, range extent, and connectivity and which accounts for other influences that could have pervasive effects on a

species' population (such as other organisms and small population size). See Chapter 4, Terrestrial Species Component, for complete discussion.

Potential vegetation — Vegetation that would likely develop if all successional sequences were completed without human interference under present site conditions.

Potential Vegetation Group (PVG) — A group of potential vegetation types, grouped on the basis of similar general moisture or temperature environment and similar types of life forms.

Potential Vegetation Type (PVT) — A kind of physical and biological environment that produces a kind of vegetation; the species that might grow on a specific site in the absence of disturbance; can also refer to vegetation that would grow on a site in the presence of frequent disturbance that is an integral part of the ecosystem and its evolution. PVTs are identified by and named for indicator species of similar environmental conditions; for example, the Douglas-fir PVT indicates a cooler and moister environment than the ponderosa pine PVT.

Practicable — Capable of being done or used for a specified purpose.

Predator — Organism that captures and feeds on parts or all of an organism of another species.

Preferred alternative — The alternative identified in a Draft Environmental Impact Statement which has been initially selected by the agency as the most acceptable resolution to the problems identified in the purpose and need.

Prescribed fire — Intentional use of fire under specified conditions to achieve specific management objectives.

Prescribed natural fire — See "Wildland Fire Use for Resource Benefit".

Prescription — A management pathway to achieve a desired objective(s).

Productivity — (1) *Soil productivity*: the capacity of a soil to produce plant growth, due to the soil's chemical, physical, and biological properties (such as depth, temperature, water-holding capacity, and mineral, nutrient, and organic matter content). (2) *Vegetative productivity*: the rate of production of vegetation within a given period. (3) *General*: the innate capacity of an environment to support plant and animal life over time.

Programmatic EIS — An area-wide EIS that provides an overview when a large-scale plan is being prepared for the management of federally administered lands on a regional or multi-regional basis. A programmatic EIS is a necessary analysis of the affected environment and the potential cumulative effects of the reasonably foreseeable actions under that program or within that geographical area. Analyses of lesser scope or more site-specificity may be tiered to the analysis in a programmatic EIS.

Project area — In this EIS, refers to Forest Service- and BLM-administered lands to which decisions in the ICBEMP Record of Decision will apply. It encompasses both the "Eastside" and "UCRB" planning areas as described in the Draft EISs, minus the areas excluded from the decision space (see the Project Area section in Chapter 1).

Proper Functioning Condition (PFC) — Riparian and wetland areas achieve Proper Functioning Condition when adequate vegetation, landform, or large woody debris is present to dissipate stream energy associated with high water flows. This thereby reduces erosion and improves water quality; filters sediment, captures bedload, and aids floodplain development; improves floodwater retention and groundwater recharge; develops root masses that stabilize streambanks against cutting action; develops diverse ponding and channel characteristics to provide habitat and water depth, duration, and temperature necessary for fish production, waterfowl breeding, and other uses; and supports greater biodiversity. The functioning condition of riparian and wetland areas is a result of the interaction among geology, soil, water, and vegetation.

Proposed action — A proposal by a federal agency to authorize, recommend, or implement an action.

Q

Qualitative — Traits or characteristics that relate to quality and can't be measured with numbers.

Quality of life — Refers to the satisfaction people feel for the place where they live (or mayvisit) and for the place they occupy as part of that experience.

Quantitative — Traits or characteristics that can be measured with numbers.

R

RAC/PAC — Resource Advisory Council/Provincial Advisory Committee areas. Resource advisory councils (RACs) were established by the BLM to provide a forum for non-federal partners to engage in discussion with agency managers regarding management of federal lands. Provincial advisory committees (PACs) were established by the Forest Service, under the Northwest Forest Plan, to provide a forum for non-federal groups and individuals to advise and make recommendations to agency land managers regarding management of federal lands.

Rainshadow — An area where little or no rain falls because it is located to the leeward side of a mountain or range whose opposite side is exposed to moisture-laden winds.

Rangeland — Land on which the native vegetation is predominantly grasses, grass-like plants, forbs, or shrubs; not forest.

Rangeland health — The degree to which the integrity of the soil and the ecological processes of rangeland ecosystems are sustained.

Record of Decision (ROD) — An official document in which a deciding official states the alternative that will be implemented from a prepared Final EIS.

Recovery — (1) Return of an ecosystem to a specified condition after a disturbance; (2) return of a previously threatened or endangered species to a condition of population viability.

Recovery plan — Identifies, justifies, and schedules the research and management actions necessary to reverse the decline of a species and ensure its long-term survival.

Recreation Opportunity Spectrum (ROS) — A framework for stratifying and defining classes of outdoor recreation environment, activities, and experience opportunities. The settings, activities, and opportunities for obtaining experiences have been arranged along a continuum or spectrum divided into seven classes: Primitive, Semiprimitive Nonmotorized, Semiprimitive Motorized, Roaded Modified, Roaded Natural, Rural, Urban.

Recreation Visit — A visit by one individual to a recreation area for the purpose of participating in one or more recreation activities for any length of time. (Only the primary activity for the visitor is recorded.)

Redd — Spawning nest made by salmon or steelhead in the gravel bed of a river.

Reforestation — Treatments or activities that help to regenerate stands of trees after disturbances such as harvest or wildfire. Typically, reforestation activities include preparing soil, controlling pests, and planting seeds or seedlings.

Refugia — Areas that have not been exposed to great environmental changes and disturbances undergone by the region as a whole; refugia provide conditions suitable for survival of species that may be declining elsewhere.

Regeneration — The process of establishing new plant seedlings, whether by natural means or artificial measures (planting).

Regional — In this EIS, generally refers to either the planning area (EIS area) or the project area (entire ICBEMP). In watershed discussions, also refers to first field hydrologic unit codes.

Rehabilitate — To repair and protect certain aspects of a system so that essential structures and functions are recovered, even though the overall system may not be exactly as it was before.

Resident fish — Fish that spend their entire life in freshwater; examples in the UCRB include bull trout and westslope cutthroat trout.

Resilient, resilience, resiliency — (1) The ability of a system to respond to disturbances. Resiliency is one of the properties that enable the system to persist in many different states or successional stages. (2) In human communities, refers to the ability of a community to respond to externally induced changes such as larger economic or social forces.

Resolution — (1) Degree of detail (finer resolution provides greater detail); (2) a solution.

Resource Management Plan (RMP) — A document that provides land and resource allocations, allowable uses, and resource goals, objectives, management actions, and monitoring for the Bureau of Land Management; required under the Federal Land Policy and Management Act.

Restoration — Holistic actions taken to modify an ecosystem to achieve desired, healthy, and functioning conditions and processes. Generally refers to the process of enabling the system to resume acting or continue to act following disturbance as if the distur-

bances were absent. Restoration management activities can be either active (such as control of noxious weeds, thinning of over-dense stands of trees, or redistributing roads) or more passive (more restrictive, hands-off management direction that is primarily conservation oriented).

Revegetation — Establishing or re-establishing desirable plants on areas where desirable plants are absent or of inadequate density, by management alone (natural revegetation) or by seeding or transplanting (artificial revegetation).

Riffle — Relatively shallow section of a stream or river with rapid current and a surface broken by gravel, rubble, or boulders.

Riparian area — Area with distinctive soil and vegetation between a stream or other body of water and the adjacent upland; includes wetlands and those portions of floodplains and valley bottoms that support riparian vegetation.

Riparian conservation area (RCA) — Delineated areas that encompass riparian ecosystems. Management activities in RCAs will be governed by ICBEMP objectives, standards, and guidelines when the Record of Decision is signed.

Riparian ecosystem — An ecosystem that is a transition between terrestrial and aquatic ecosystems; includes streams, lakes, wet areas, and adjacent vegetation communities and their associated soils which have free water at or near the surface; an ecosystem whose components are directly or indirectly attributed to the influence of water.

Risk assessment — Process of gathering data and making assumptions to estimate short- and long-term harmful effects on human health or the environment from particular products or activities.

Road — *BLM:* A route open normally to highway vehicles (such as trucks and automobiles); route may be improved, is maintained by mechanical means, and receives regular and continuous use; route must have purpose and intent to be maintained when necessary. *Forest Service*: A classified road is at least 50 inches wide and constructed andmaintained for vehicle use. An unclassified road is considered a road that was not constructed, maintained, or intended for highway use.

Rotation — Refers to each generation of a managed forest; the number of years between the time that a forest stand is regenerated and its final harvest.

Rubble — Loose, angular rock fragments.

Runoff (surface) — Fresh water from precipitation and melting ice that flows on the earth's surface into nearby streams, lakes, wetlands, and reservoirs.

S

Salmonids — Fishes of the family Salmonidae, including salmon, trout, chars, whitefish, ciscoes, and grayling.

Salvage — Harvest of trees that are dead, dying, or deteriorating due to fire, wind, insect or other damage, or disease.

Salvage sale — A timber sale undertaken to remove dead, dying, or deteriorating trees before the wood becomes worthless for processing into wood products and/or to prevent the spread of insects and diseases and thereby promote more healthy forests.

Scale — (1) The level of resolution under consideration (for example, broad scale or fine scale); (2) the ratio of length on a map to true length.

Scientific Assessment — Refers to two documents produced by the ICBEMP Science Integration Team: *An Integrated Scientific Assessment for Ecosystem Management in the Interior Columbia Basin and Portions of the Klamath and Great Basins* (Quigley, Graham, and Haynes 1996), which examines historical and current biophysical, social, and economic systems in the project area; and the associated Staff Area Reports (STARs) published as *An Assessment of Ecosystem Components [AEC] in the Interior Columbia Basin and Portions of the Klamath and Great Basins* (Quigley and Arbelbide 1996).

Scoping — The early stages of preparation of an environmental impact statement, used to solicit public opinion, receive comments and suggestions, and determine the issues to be considered in the development and analysis of a range of alternatives. Scoping may involve public meetings, telephone conversations, mailings, letters, or other contacts.

Secure — Generally refers to reducing immediate threats to at-risk or non-functioning processes or resources through protection or restoration; also used to refer to acquisition or retention of water rights.

Sediment — Solid materials, both mineral and organic, in suspension or transported by water, gravity, ice, or air; may be moved and deposited away from their original position and eventually will settle to the bottom.

Seed trees — Mature trees left standing after timber harvest to provide seeds to regenerate the new stand; a harvest prescription.

Selective cutting — Cutting of intermediate-aged, mature, or diseased trees in an uneven-aged forest stand, either singly or in small groups. This encourages growth of younger trees and maintains an uneven-aged stand.

Semi-arid — Moderately dry; region or climate where moisture is normally greater than under arid conditions but still definitely limits the production of vegetation.

Sense of place — Refers to how individuals or groups define and relate to specific geographic locations.

Sensitive species — Species identified by a Forest Service regional forester or BLM state director for which population viability is a concern either (a) because of significant current or predicted downward trends in population numbers or density, or (b) because of significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution.

Seral — Refers to the stages that plant communities go through during succession. Developmental stages have characteristic structure and plant species composition. Early seral refers to plants that are present soon after a disturbance or at the beginning of a new successional process (such as seedling or sapling growth stages in a forest); mid seral in a forest would refer to pole or medium sawtimber growth stages; late or old seral refers to plants present during a later stage of plant community succession (such as mature and old forest stages).

Seral stage — The developmental phase of a forest stand or rangeland with characteristic structure and plant species composition.

Shade-intolerant — Species of plants that do not grow well in or die from the effects of too much shade. Generally these are fire-tolerant species.

Shade-tolerant — Species of plants that can develop and grow in the shade of other plants. Generally these are fire-intolerant species.

Short-term — Generally refers to a period of 10 years or less.

Shrink-swell potential — The susceptibility of soil to change in volume due to a loss or gain in moisture content. A shrink-swell potential is typically associated with soils that have a high percentage of clay.

Silviculture — The practice of manipulating the establishment, composition, structure, growth, and rate of succession of forests to accomplish specific objectives.

Site — A specific location of an activity or project, such as a campground, a lake, or a stand of trees to be harvested.

Site potential — A measure of resource availability based on interactions among soils, climate, hydrology, and vegetation. Site potential represents the highest ecological status an area can attain given no political, social, or economic constraints. It defines the capability of an area, its potential, and how it functions.

Site potential tree height (SPTH) — The average maximum height of the tallest trees (200 years or older) for a given site class.

Smolt — Young salmon or trout migrating to the ocean and undergoing biological changes to enable them to move from freshwater streams to saltwater.

Snag — A standing dead tree, usually larger than five feet tall and six inches in diameter at breast height. Snags are important as habitat for a variety of wildlife species and their prey.

Soil — The earth material that has been so modified and acted upon by physical, chemical, and biological agents that it will support rooted plants.

Soil disturbance — In this EIS, used to describe effects of the alternatives on soil productivity.

Soil organic matter — A variety of compounds derived from weathering and decomposition of plant residue. Organic matter within the litter layer or surface soil horizon is an important nutrient reservoir for maintaining soil productivity.

Soil productivity — See productivity.

Soil structure — Refers to the physical structure of soils that enables air and water to move or be stored.

Soil texture — Relative amounts of sand, silt, and clay in a soil. Coarse-textured soils are generally sandy and often contain gravel of various sizes; fine-textured soils are very fine, sandy, silty, or clayey.

Source habitat — Those characteristics of vegetation that support long-term wildlife species persistence, or characteristics of vegetation that contribute to stable or positive population growth for a species in a specified area and time. Source habitats are described in Wisdom et al. (in press) using dominant vegetation

cover type and structural stage combinations that can be estimated reliably at the 247-acre (100-hectare) patch scale. Various combinations of these cover type–structural stages make up the source habitats for the terrestrial species discussed in this EIS, and provide the range of vegeation conditions required by these species for food, reproduction, and other needs.

Spatial — Related to or having the nature of space.

Spawning habitat — Areas used by adult fish for laying and fertilizing eggs.

Special status species — Refers to federally listed threatened, endangered, proposed, or candidate species; and species managed as sensitive species by the Forest Service and/or BLM.

Species — A population or series of populations of organisms that can interbreed freely with each other but not with members of other species.

Species richness — A measure of biological diversity, referring to the number of species in an area.

Species-seasonal combination — Represents a species and the season of year (summer, winter, or year-long) during which it uses source habitat. It also indicates that some species may migrate within or outside the project area. For example: blue grouse use forest mosaic habitat (Family 3) in the summer and broad-elevation old forests (Family 2) in the winter.

Stability — Ability of a living system to withstand or recover from externally imposed changes or stresses.

Stand — A group of trees in a specific area that are sufficiently alike in composition, age, arrangement, and condition so as to be distinguishable from the forest in adjoining areas.

Standard (management) — In this EIS, refers to required action, priority, process, or prescription that addresses how to achieve one or more objective(s). Standards can include restrictions on or prohibitions from taking an action in certain situations. Compliance with standards is mandatory.

Stand composition — The vegetative species that make up the stand.

Stand density — Refers to the number of trees growing in a given area, usually expressed in trees per acre.

Stand-replacing fire — See lethal fire.

Stand structure — The mix and distribution of tree sizes, layers, and ages in a forest. Some stands are all one size (single-story), some are two-story, and some are a mix of trees of different ages and sizes (multi-story).

State Implementation Plan (SIP) — A document prepared by each state describing existing air quality conditions and measures that will be taken to attain and maintain national ambient air quality standards.

Step-down — In this EIS, refers to the process of applying broad-scale science findings and land use decisions to site-specific areas using a hierarchical approach of understanding current resource conditions, risks, and opportunities.

Stewardship — Responsibility of federal agencies to manage natural resources on public land.

Stewardship harvest/stewardship thinning — Commercial timber harvest where the primary reason for harvesting timber is to obtain a land use plan objective that requires vegetation manipulation. Therefore, even if the timber could not be sold, the harvest would still take place or be accomplished through another means, such as prescribed fire.

Stream morphology — The study of the form and structure of streams.

Strongholds (fish) — Watersheds or subwatersheds that have the following characteristics: (1) presence of all major life-history forms (for example, resident, fluvial, and adfluvial) that historically occurred within the watershed; (2) numbers are stable or increasing, and the local population is likely to be at half or more of its historical size or density; (3) the population or metapopulation within the watershed, or within a larger region of which the watershed is a part, probably contains at least 5,000 individuals or 500 adults.

Structure — The size and arrangement, both vertically and horizontally, of vegetation.

Structural stage — A stage of development of a vegetation community that is classified on the dominant processes of growth, development, competition, and mortality.

Subalpine — A terrestrial community that generally is found in harsher environments than the montane terrestrial community. Subalpine communities are generally colder than montane and support a unique clustering of wildlife species.

Subbasin — A drainage area of approximately 800,000 to 1,000,000 acres, equivalent to a 4th-field hydrologic unit code (HUC). Hierarchically, subwatersheds (6th-field HUC) are contained within a watershed (5th-field HUC), which in turn are contained within a subbasin (4th-field HUC). This concept is shown graphically in Figure 2-1.

Subregional — In this EIS, generally refers to areas geographically smaller than "regional" but larger than a national forest or BLM district. In watershed discussions in this EIS, the term also refers to the equivalent of a second field hydrologic unit code, an area of about 22 million acres.

Subsistence — Customary and traditional uses of wild renewable resources (plants and animals) for food, shelter, fuel, clothing, tools, etc.

Subspecies — A distinct, geographically separated group of organisms within a species.

Substrate — The soil or underlying rock on which an organism is growing or to which it is attached.

Subwatershed — A drainage area of approximately 20,000 acres, equivalent to a 6th-field Hydrologic Unit Code (HUC). Hierarchically, subwatersheds (6th-field HUC) are contained within watershed (5th-field HUC), which in turn contained within a subbasin (4th-field HUC). This concept is shown graphically in Chapter 2.

Succession — A predictable process of changes in structure and composition of plant and animal communities over time. Conditions of the prior plant community or successional stage create conditions that are favorable for the establishment of the next stage. The different stages in succession are often referred to as seral stages.

Successional momentum — The increasing departure (change) of landscape vegetation, structure, composition, patch, pattern, and disturbance regimes away from the historical range at an increasing rate.

Surface fire — A fire that burns surface litter, dead woody fuels, other loose debris on the forest floor, and some small vegetation, without significant movement into the overstory, usually with a flame less than a few feet high.

Sustainability — (1) Meeting the needs of the present without compromising the abilities of future generations to meet their needs; emphasizing and maintaining the underlying ecological processes that ensure long-term productivity of goods, services, and values without impairing productivity of the land. (2) In commodity production, refers to the yield of a natural resource that can be produced continually at a given intensity of management.

Synergism (synergistic) - Cooperative actions such that the total effect is greater than the sum of the effects taken independently.

T

T — Terrestrial T watersheds (5th-field HUCs) identified by the EIS Team based on whether they contained source habitat for one or more of five "Families" of terrestrial species. These five Families represent groups of species associated with habitats that have declined substantially in the project area since the historical period. In addition, the pattern of source habitats within these watersheds is most similar to that found historically. T watersheds alone do not constitute a network of habitats for terrestrial species; however, they are one piece of the overall strategy to maintain and restore networks of habitat for terrestrial species.

Taxa (taxon) — Group of organisms that share common characteristics that differ from other groups and form the basis for categories of classification such as species, genus, family.

Tectonic — Relating to, causing, or resulting from structural deformation of the earth's crust.

Temporal — Related to time.

Terrestrial — Pertaining to the land.

Terrestrial communities — Groups of cover types with similar moisture and temperature regimes, elevational gradients, structures, and use by vertebrate wildlife species.

Terrestrial Family — An aggregate of groups of broad-based terrestrial vertebrate species of focus for ICBEMP, organized into "families" based on habitat requirements (Wisdom et al. in press). Twelve Terrestrial Families are discussed in this EIS.

Terrestrial Group — An aggregate of broad-scale terrestrial vertebrate species of focus for ICBEMP, organized into groups based on habitat requirements (Wisdom et al. in press). Forty terrestrial groups were identified.

Thermal cover — Cover used by animals to protect them against weather.

Thinning — An operation to remove stems from a forest for the purpose of reducing fuel, maintaining stand vigor, regulating stand density/composition, or for other resource benefits. Although thinning can result in commercial products, for the purposes of this EIS, thinning generally refers to non-commercial operations.

Threatened species — Species listed under the Endangered Species Act that are likely to become endangered within the foreseeable future throughout all or a significant portion of their range.

Tier — In an EIS, refers to incorporating by reference the analyses in an EIS of a broader scope. For example, a Forest Service project-level EIS could tier to the analysis in a Forest Plan EIS; a Forest Plan EIS could tier to a Regional Guide EIS.

Topography — Physical features of the ground surface such as hills, plains, mountains, steepness of slope, and other features.

Traditional timber harvest — A commercial operation to remove stems from a forest for the primary purpose of economic gain, with mitigation for other resources, such as forest health or wildlife, secondary in priority.

Transpiration — Water loss from plants during the course of photosynthesis.

Tribe — Term used to designate any Indian tribe, band, nation, or other organized group or community (including any Alaska Native village or regional or village corporation as defined in or established pursuant to the Alaska Native Claims Settlement Act) which is recognized as eligible for the special programs and services provided by the United States to Indians because of their status as Indians.

True firs — Coniferous trees of the genus *Abies*. Grand fir (*Abies grandis*) and Subalpine fir (*A. lasiocarpa*) are examples of true firs found in the project area. Douglas-fir (*Pseudotsuga menziesii*) is in a different genus and is more closely related to hemlocks than to true firs.

Trustee/Trust responsibilities (tribal) — A trustee is one who holds property for the benefit of another. The federal government's trust responsibility arises from promises made in treaties, executive orders, and agreements. The primary focus of the federal government trust responsibility is the protection of Indian-owned assets, natural resources on reservations, and the treaty rights and interests that tribes reserved on off-reservation lands.

Turbidity — The condition of a body of water that contains suspended material such as clay or silt particles, dead organisms, or small living plants and animals.

U

Umbrella species — A large-bodied wildlife species that has a large home range and broad requirements for habitats and resources; managing for an umbrella species is assumed to provide habitats and resources for other species.

Underburn — A burn by a surface fire that can consume ground vegetation and ladder fuels.

Understory — Plants that grow beneath the canopy of other plants. Usually refers to grasses, forbs, and low shrubs under a tree or shrub canopy.

Uneven-aged management — Method of forest management in which trees of different species in a given stand are maintained at many ages and sizes to permit continuous natural regeneration. Selective cutting is one example of an uneven-aged management method.

Uneven-aged stand — Stand of trees in which there are considerable differences in the ages of individual trees.

Ungulates — Hoofed, plant-eating mammals such as elk, deer, and cattle.

Unroaded area — Portion of the National Forest System that does not contain classified roads (see Road).

Unstable and potentially unstable lands — The unstable land component includes lands that are prone to mass failure under natural conditions (unroaded, unharvested), and where human activities such as road construction and timber harvest are likely to increase landslide distribution in time and space, to the point where this change is likely to

modify natural geomorphic and hydrologic processes (such as the delivery of sediment and wood to channels), which in turn will affect aquatic ecosystems including streams, seeps, wetlands, and marshes.

The following types of land are included: (1) active landslides and those that exhibit sound evidence of movement in the past 400 years; (2) inner gorges; (3) those lands identified as unstable by geologic investigations, using the criteria stated above (includes lands already classified by the Forest Service as unsuited for programmed timber harvest because of irreversible soil loss, and by the BLM as nonsuitable fragile lands). Highly erodible lands (that is, lands prone to sheet and rill erosion) are not included in this definition.

Upland — The portion of the landscape above the valley floor or stream.

V

Vascular plants — Plants that have specialized tissues which conduct nutrients, water, and sugars, along with other specialized parts such as roots, stems, and reproductive structures. Vascular plants include flowering plants, ferns, shrubs, grasses, trees, and many others.

Vegetative composition — The plant species present in a plant community.

Vertebrate — An animal with a backbone; mammals, fishes, birds, reptiles, and amphibians are vertebrates.

Viability — In general, viability means the ability of a population of a plant or animal species to persist for some specified time into the future. For planning purposes, a *viable population* is one that has the estimated numbers and distribution of reproductive individuals to ensure that its continued existence will be well distributed in the planning area.

Viable population — A population that is regarded as having the estimated numbers and distribution of reproductive individuals to ensure that its continued existence is well distributed in the project area.

Visual resources — The visible physical features of a landscape.

W

Water Quality Limited — A Clean Water Act classification for waters where application of best management practices or technology-based controls are not sufficient to achieve designated water quality standards.

Watershed — (1) The region draining into a river, river system, or body of water. (2) In this EIS, a watershed also refers specifically to a drainage area of approximately 50,000 to 100,000 acres, which is equivalent to a 5th-field Hydrologic Unit Code (HUC). Hierarchically, subwatersheds (6th-field HUC) are contained within a watershed (5th-field HUC), which in turn is contained within a subbasin (4th-field HUC). This concept is shown graphically in Figure 2-1.

Watershed Condition Indicators (WCIs) — An integrated suite of aquatic (including a biological component), riparian (including riparian-associated terrestrial species), and hydrologic (including uplands) condition measures that are intended to be used at the watershed scale. They are intended to assist in effectiveness monitoring and to indicate the current condition of a watershed in order to help land managers design projects. See Chapter 3, Base Level, Aquatic-Riparian-Hydrologic Component for details.

Weed — A plant considered undesirable, unattractive, or troublesome, usually introduced and growing without intentional cultivation.

Wetland — In general, an area soaked by surface or groundwater frequently enough to support vegetation that requires saturated soil conditions for growth and reproduction; generally includes swamps, marshes, springs, seeps, bogs, wet meadows, mudflats, natural ponds, and other similar areas. Legally, federal agencies define wetlands as possessing three essential characteristics: (1) hydrophytic vegetation, (2) hydric soils, and (3) wetland hydrology. The three technical characteristics specified are mandatory and must all be met for an area to be identified as a wetland. *Hydrophytic vegetation* is defined as plant life growing in water, soil, or on a substrate that is at least periodically deficient in oxygen as a result of excessive water content. *Hydric soils* are defined as soils that are saturated, flooded, or ponded long enough during the

growing season to develop anaerobic (without oxygen) conditions in the upper part of the soil profile. Generally, to be considered a hydric soil, there must be saturation at temperatures above freezing for at least seven days. *Wetland hydrology* is defined as permanent or periodic inundation, or soil saturation to the surface, at least seasonally.

Widely distributed species — Those species that occur on more than one administrative unit. Widely distributed species may be fine scale or broad scale depending on habitat resolution; however, in this EIS it was possible to disclose specific quantitative effects of the alternatives only on widely distributed species whose habitats could be reliably mapped using a block size of at least 247 acres.

Wide-ranging carnivores — In this EIS, refers to lynx, wolverine, grizzly bear, and gray wolf, which are considered wide-ranging because their territories cover great distances (often more than 50 miles).

Wilderness — Area where the earth and its community of life have not been seriously disturbed by humans and where humans are only temporary visitors. Specific lands may be designated by the U. S. Congress as wilderness areas and protected and managed to preserve their natural condition; "wilderness" can also refer to other areas that have pristine and natural characteristics.

Wildfire — A human or naturally caused fire that does not meet land management objectives.

"Wildland Fire Use for Resource Benefit" — Formerly referred to as "prescribed natural fire." A fire ignited by lightning but allowed to burn within specified conditions of fuels, weather, and topography, to achieve specific objectives.

Windthrow — Trees blown over by the wind.

Woody — Composed of wood or woody fibers.

X

Xeric — Very dry region or climate; tolerating or adapted to dry conditions.

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Key Acronyms

A1	Aquatic A1 Subwatershed (6th-field HUC)
A2	Aquatic A2 Subwatershed (6th-field HUC)
AIRFA	American Indian Religious Freedom Act
ARPA	Archaeological Resources Protection Act
ASQ	Allowable Sale Quantity
AUM	Animal Unit Month
BEA	Bureau of Economic Analysis
BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
BMP	Best Management Practice
BO	Biological Opinion
CDP	Census-designated Place
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CRBSUM	Columbia River Basin Successional Model
CWAP	Clean Water Act Protocol
CWD	Coarse Woody Debris
DBH	Diameter at Breast Height
DEIS	Draft Environmental Impact Statement
EAWS	Ecosystem Analysis at the Watershed Scale
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ERU	Ecological Reporting Unit
ESA	Endangered Species Act
ESC	Executive Steering Committee (ICBEMP)
FACA	Federal Advisory Committee Act
FEIS	Final Environmental Impact Statement
FEMAT	Forest Ecosystem Management Assessment Team
FERC	Federal Energy Regulatory Commission
FLPMA	Federal Lands Policy and Management Act
FOIA	Freedom of Information Act
FSEEE	Forest Service Employees for Environmental Ethics
GIS	Geographic Information System
HRV	Historical Range of Variability
HUC	Hydrologic Unit Code
ICBEMP	Interior Columbia Basin Ecosystem Management Project
IWM	Integrated Weed Management
MMBF	Million Board Feet
MOU	Memorandum of Understanding
NAAQS	National Ambient Air Quality Standards
NAGPRA	Native American Graves Protection and Repatriation Act
NEPA	National Environmental Policy Act
NFMA	National Forest Management Act
NMFS	National Marine Fisheries Service
NOI	Notice of Intent
NWFP	Northwest Forest Plan
PAC	Provincial Advisory Committee
PFC	Proper Functioning Condition
PILT	Payment in Lieu of Taxes
PVG	Potential Vegetation Group
PVT	Potential Vegetation Type
RAC	Resource Advisory Council
RCA	Riparian Conservation Area
RIST	Regional Implementation Support Team
RMO	Riparian Management Objective
ROD	Record of Decision
ROS	Recreation Opportunity Spectrum
RHCA	Riparian Habitat Conservation Area
SAG	Science Advisory Group (ICBEMP)
SIT	Science Integration Team (ICBEMP)
SDEIS	Supplemental Draft Environmental Impact Statement
T	Terrestrial T Watershed (5th-field HUC)
TEP	Threatened, Endangered, or Proposed Species
TERO	Tribal Employment Rights Office
TMDL	Total Maximum Daily Load
UCRB	Upper Columbia River Basin
USDA	U.S. Department of Agriculture
USDI	U.S. Department of the Interior
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WCI	Watershed Condition Indicator